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INFECTION OF THE URINE AND THE URINARY TRACT BY BACILLUS COLI IN INFANCY.

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While infants do have ascending infections of the bladder and kidneys from urethritis of various sorts, severe inflammations of the bladder from stone with secondary pyelitis and pyonephrosis, tuberculosis of the bladder and kidneys, and all of the other diseases of these organs which occur in adults, they have them extremely rarely, so rarely, in fact, that they may almost be regarded as among the curiosities of medicine. Bacterial infection of the urine and urinary tract with the presence of pus in the urine, associated in some cases with epithelium of various sorts and occasionally with casts, is, however, not at all uncommon. It is usually not recognized, however, as most physicians are not familiar with the condition, or, if so, do not bear it in mind. In the vast majority of cases the infection is with the colon bacillus, although Bacillus lactis aërogenes, the typhoid bacillus, Bacillus proteus vulgaris, and several others have been found in rare instances. This condition has been described by various authors under various names, bacteriuria, pyelitis, cystopyelitis, colicystitis, pyelonephritis—according to the individual author's idea of the location of the infection, their opinions apparently having been based on the microscopic appearances of the urine. How difficult or even impossible it is to determine the exact seat of the lesion, and hence to give the condition a definite

name, will be evident later. It seems safer, therefore, to speak of this condition as infection of the urinary tract by Bacillus coli.

MODE OF INFECTION. Theoretically, infection of the urine and the urinary tract by the colon bacillus can occur in three ways: (1) Through the blood—hematogenous or descending theory; (2) through the urethra—ascending theory; and (3) through the tissues between the intestines and bladder—transparietal theory.

1. *Descending Theory.* It is well known that a general bacterial invasion occurs in the course of many diseases. It was suggested by Cohnheim that in this event the body protected itself by the excretion of living organisms through the intact kidney. Other observers, notably Sherrington, have shown, however, that while organisms injected into the blood may escape in this way, the excretion is neither rapid nor immediate and may not occur at all. It is probable, therefore, that organisms pass through the kidneys only after the secreting tissues have been injured (Wyssokowicz[1]). The urine in these cases, however, does not, as a rule, show any evidences of injury to the renal tissue, containing only occasionally hyaline and fine granular casts, almost never blood, and seldom much albumin. The fact that pathological lesions of the pelvis of the kidney have been found at autopsy without any lesions of the ureters or bladder points very strongly, nevertheless, to a blood infection in some cases, at least (Knox,[2] Carpenter,[3] Finkelstein,[4] Baginsky[5]). So does the demonstration by cystoscopic examination of reddened ureteral orifices discharging pus into a normal bladder (Abt[6]).

Colon bacilli have been found in the blood of living infants ill with intestinal diseases (Czerny,[7] Moser,[8] Escherich[9]), and frequently in the blood and organs after death (Welch,[10] Marfan et Nanu,[11] Macaigne,[12] Finkelstein). On the other hand, they have not been found in the blood in some cases in which they were present in the urine (Moll,[13] Finkelstein), a fact pointing strongly, of course, to some other method of infection. Moreover, while the colon bacilli have frequently been found in the blood of boys, Bacillus coli infection of the urinary tract in them is rare (Finkelstein).

The fact that a large number of these cases are in girls points to some other method of infection, that is, through the urethra. Boys have this condition also, however, and in them an ascending infection is very improbable. In fact, almost 40 per cent. of my fifty patients were boys. In two of them, however, the infection was ascending as the result of circumcision.

[1] Zschr. f. Hygiene, 1908, lix, 1.
[2] Jour. Amer. Med. Assoc., 1907, ii, 1975.
[3] Ibid., 2004.
[4] Jahrb. f. Kinderheilk., 1896, xliii, 148.
[5] Deut. med. Woch., 1897, xxiii, 400.
[6] Jour. Amer. Med. Assoc., 1907, ii, 1972.
[7] Quoted by Cnopf.
[8] Quoted by Cnopf.
[9] Centralbl. f. Bact. u. Parasit., 1894, xv, 901.
[10] Quoted by Cnopf.
[11] Quoted by Cnopf.
[12] Quoted by Cnopf.
[13] Prag. med. Woch., 1907, xxxii, 501.

2. *Ascending Theory.* The chief arguments in favor of an ascending infection from the urethra are the much greater frequency of this condition in females, and the short, wide urethra which makes infection easy when the external genitals are soiled by feces. An argument against ascending infection is the fact that cystitis is a comparatively unusual complication of vulvovaginitis in infancy (Hutinel,[14] Baginsky, and others). Other arguments in favor of ascending infection as against descending infection are that in certain cases the urine is characteristic of cystitis, while in others the autopsy has shown lesions of the mucous membrane of the bladder while that of the ureters and pelves has been intact (Finkelstein).

The mere entrance of the colon bacillus into the bladder is not of itself sufficient to cause cystitis, as is shown by the fact that the injection of cultures of Bacillus coli into the bladder of puppies does not cause cystitis (Caccia[15]). In order that cystitis may develop there must be some abnormality of the bladder mucous membrane, diuresis must be interfered with, or the virulence of Bacillus coli exalted. The effect of hyperemia and lesions of the mucous membrane of the bladder or of stasis, produced by ligation of the penis, is proved by the experiments of Albaran and Halle,[16] who under these conditions were able to produce Bacillus coli cystitis by the injection of the colon bacillus through the urethra. The explanation given for the well-known fact that invasions of the urinary tract by the colon bacillus are especially common after or in connection with intestinal disturbances is that the inflammation of the colon causes tenesmus, the diarrhœa diminishes diuresis, and the indigestion or enteritis increases the virulence of the colon bacillus, while the general toxemia diminishes the resistance of the bladder mucous membrane by the cardiac weakness or degeneration of the epithelium which it produces. Trumpp,[17] however, found Bacillus coli in the urine of 14 of 17 infants—9 girls and 5 boys—ill with intestinal disorders without any other signs of infection, while Escherich's investigations have shown no increase in the virulence of the organism in cases of urinary infection with the colon bacillus.

3. *Transparietal Theory.* This conception presupposes some lesion of the intestinal mucous membrane, as various experimenters have shown that the colon bacillus cannot traverse the normal intestinal mucous membrane. Reymond[18] has shown that in adults Bacillus coli salpingitis and metritis are sometimes complicated by Bacillus coli cystitis. In these cases there are corresponding areas of inflammation in the bladder and in the organs outside, pointing to the direct passage of the organisms, and relief of the genital disease is followed by that of the cystitis. Wreden[19] has called attention to

[14] Presse méd., 1896, iv, 625.
[15] Riv. di Clinica Pediatrica, 1907, Abstract in Archives de méd. des enfants, 1907, x, 705.
[16] Quoted by Caccia.
[17] Jahrb. f. Kinderheilk, 1897, xliv, 208.
[18] Ann. des mal. des organes génito-urin., 1893, 253.
[19] Centralbl. f. Chirurgie, 1893, xx, 577.

the intimate anatomical relations between the colon and bladder in the male, and has shown by experiments on male rabbits that every injury of the mucous membrane of the colon at the level of the prostate or higher is followed by cystitis. The bacteria found in the urine in these cases were those found commonly in the intestines of rabbits. Vaseline and oil were found in the urine when these substances were injected into the bowel after injuring the intestinal mucosa. He concludes, therefore, that in males, at any rate, the colon bacillus can pass directly from the intestine to the bladder. Posner and Lewis,[20] however, state that bacteria have never been found in the tissues between the intestine and the bladder, while Posner and Cohen[21] have shown that when the renal artery is previously ligated the urine remains sterile. Consequently they believe that the infection is hematogenous.

Infection of the bladder, as already stated, is impossible while the mucous membrane is normal. Inflammation of the large intestine, because of the anatomical relations, produces congestion of the bladder mucous membrane and thus predisposes to infection, while in severe cases the rectal tenesmus modifies the function of the bladder and diminishes diuresis. The fact that urinary infection with the colon bacillus occurs most often in connection with or subsequent to intestinal disturbances is another argument in favor of the transparietal theory.

The examination of the urine does not aid a great deal in the determination of the method of infection. In many cases the urine contains only bacteria or bacteria and pus cells, a condition consistent with any method of infection. In some cases the urine also contains caudate cells and casts, suggesting that the severest process, and probably the earliest, is in the kidney and pelvis, and that the infection is therefore hematogenous or transparietal. In others the urine contains no casts or caudate cells, but considerable quantities of squamous cells, suggesting that the severest and presumably the earliest pathological process is in the bladder and that the infection is either through the urethra or transparietal.

It is evident from the consideration of these theories, it seems to me, that the method of infection is not always the same. It seems reasonable to conclude, however, that in the majority of the cases in girls the infection is through the urethra, while this route is very unusual in boys, and then only when there is some evident lesion, such as phimosis causing stasis, severe balanitis, or an infected wound from circumcision. In most cases in boys, and in a fair proportion of those in girls, the infection is probably transparietal, while in both sexes it is occasionally hematogenous.

PATHOLOGY. The pathological changes in these cases are slight, some reddening and swelling of the mucous membrane of a part

[20] Berl. klin. Woch., 1894, 742.
[21] Ibid., September 3, 1900. (Quoted by Ritchie,)

or of the whole of the urinary tract, some desquamation of the epithelium, and sometimes the evidences of degeneration of the lower tubules of the kidney.

Terminology. The confusion as to the terminology and the difficulty in the determination of the seat of the lesion or lesions in the infections of the urinary tract by the colon bacillus have already been mentioned. There can be little doubt, however, that the condition may vary from a simple bacteriuria without lesions of the pelvis of the kidney or of the bladder wall to one in which not only the bladder wall and the pelvis of the kidney, but also the renal tissue itself is involved. Judging from the urine and the pathological findings, the bladder is involved alone in some cases, the pelvis of the kidney alone in others, and both together in still others. It is presumable that the part first or most affected depends largely on the method of infection. In some cases the condition of the urine and the symptomatology make it evident where the chief seat of the disease, at any rate, is located. For example, the presence of considerable numbers of caudate cells indicates strongly involvement of the pelvis of the kidney; casts, an affection of the renal tissue itself; squamous cells, inflammation of the bladder wall. Tenderness in the lumbar region or in the hypogastrium points to involvement of the kidneys or the bladder, respectively. Frequent and painful micturition suggests that there is local trouble in the bladder. In many cases, however, there is nothing about either the symptomatology or the examination of the urine to aid in the localization of the process, the symptoms being entirely general and the urine containing merely bacteria and pus.

The general belief is that infection of the urinary tract with the colon bacillus in infancy is usually secondary to some disturbance of the intestinal tract, whether this be in the nature of constipation or diarrhœa. In many instances, however, no such connection can be made out, and in others it is very difficult to determine whether the intestinal disturbances are the result of the trouble in the urinary tract or the reverse. The disease was apparently primary in about two-thirds of my own cases. In two it directly followed circumcision, and in one girl the irritation from pin-worms apparently led to infection.

Bacteriuria. It must be remembered in this connection that the presence of bacteria in the urine as a secondary symptom of an infectious nephritis, or of a general infectious disease, does not constitute the disease, bacteriuria. This is a disease characterized by the presence of bacteria in exceedingly large numbers in the freshly passed urine and by the absence of marked symptoms of an inflammatory process in the mucous membrane of the urinary tract. Bacteriuria is most common in infancy and is almost always due to Bacillus coli. There are, as a rule, no severe general symptoms; at most, malaise and a slight elevation of temperature. Frequent

and painful micturition are not uncommon and older children often suffer from incontinence. The urine is uniformly cloudy, having the appearance of a bouillon culture of bacteria. The odor is unpleasant, the reaction acid. Animal experiments have shown that the virulence of the organisms in these cases is slight (Mellin[22]).

URINE. In most cases the urine is pale and uniformly cloudy or turbid. The turbidity is due in part to the bacteriuria and in part to the presence of large numbers of pus cells, chiefly to the latter. In rare instances it has a peculiar gelatinous appearance. The odor varies from normal to stale or very foul. The specific gravity is usually not increased. The reaction is almost invariably acid, not infrequently highly so. The acidity is due to the facts that Bacillus coli, although preferring an alkaline or neutral medium, can thrive in an acid medium, and that, as it does not decompose urea, it does not develop an alkaline reaction in the urine. This acidity is inimical to the growth of other organisms, so that Bacillus coli is most often found in pure culture. The urine usually contains less than 0.1 per cent. of albumin.

Microscopically, the sediment is composed almost entirely of pus cells, usually single, sometimes in clumps. Caudate, small round and squamous cells, in small numbers, are also present in many or most cases. Squamous cells are never present in large numbers, as they are in most cases of purulent inflammation, probably because of the absence of the ammoniacal products of the decomposition of urea which are the cause of the destruction and desquamation of the bladder epithelium in other infections. Hyaline and fine granular casts are occasionally seen, blood or blood elements almost never. The amount of urine is apparently uninfluenced by the disease, and varies directly with the amount of liquid ingested.

SYMPTOMATOLOGY. In the majority of cases there is nothing whatever in the symptomatology to call attention to the urinary tract, the symptoms being merely an elevation of temperature and those common to all febrile disturbances in infancy, such as restlessness, drowsiness, fretfulness, and signs of indefinite discomfort. In some cases a yellow stain on the napkin first calls attention to the urinary tract. Symptoms of disturbance of the gastro-intestinal tract are especially common. Anorexia is the rule, and is often very marked. Vomiting is not unusual. The movements are usually abnormal, sometimes as the result of some disease to which the urinary infection is secondary, sometimes as the result of the infection itself.

The temperature (Chart I) is usually very irregular and in no way characteristic, suggesting confined pus more than anything else. In some cases it suggests an atypical malaria. In fact, the condition is for this reason often mistaken for malaria. This is especially

[22] Jahrb. f. Kinderheilk, 1903. lviii, 40.

likely to happen when, as is sometimes the case, there are also chills and sweating. In some cases, however, there is no fever. The following charts (2 to 5) are good examples of the irregularities in the temperature curve.

In some instances it is evident that the baby is suffering pain somewhere. It is very seldom, however, that there are any symptoms to suggest that the location of the pain is in the bladder or kidney. The pain is often paroxysmal. In one of my cases, a male,

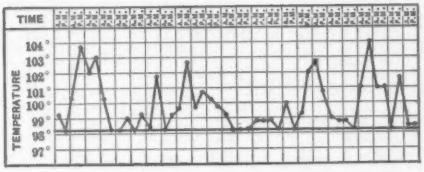

CHART I.—Irregular temperature of bacteriuria.

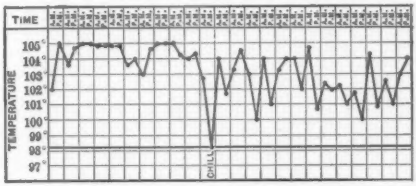

CHART II.

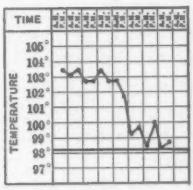

CHART III.

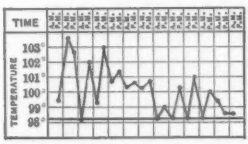

CHART IV.

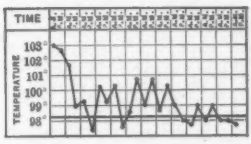

CHART V.

CHARTS II to V.—Irregular temperature of Bacillus coli infections of the urinary tract.

the attacks were apparently due to the blocking of the ureters by masses of pus. At any rate, the attacks were accompanied by swelling and tenderness of the kidney, and relief was followed by the passage of considerable amounts of urine containing macroscopic lumps of pus.

Tenderness or enlargement of the kidney is unusual. In one of my cases the enlargement was due to a non-suppurative perinephritic inflammation which required operative treatment. Tenderness over the bladder is somewhat more common. Frequent micturition is not common; sometimes there is partial retention of urine. Eneuresis

may be the chief symptom in older children. Painful micturition is, in my experience, comparatively unusual. Loss of weight is usually rapid and marked. Anemia develops rapidly. Durante[23] attributes it to the specific hemolysins formed by Bacillus coli. There was always a leukocytosis in those of my cases in which the blood was examined, the highest count being 51,700.

To sum up: In the majority of cases of infection of the urinary tract in infancy with the colon bacillus there is nothing about the symptomatology to direct attention to the urinary tract. When such symptoms are present they are usually mild and are easily overlooked. Consequently the urine should be examined in all diseased conditions with indefinite symptoms in infancy, especially if febrile, and no physical examination should be considered complete or diagnosis satisfactory in obscure conditions in infancy unless the urine has been examined. In fact, in the vast majority of cases the diagnosis can only be made by the examination of the urine.

The following histories illustrate very well the various types of the symptomatology:

CASE I.—A girl, aged thirteen months, was breast-fed for five months. She was then weaned gradually and put on a "hit-or-miss" mixture of top milk with Mellin's Food, on which she did very well. About three weeks before she was seen she began to be feverish, and was given calomel. The next day she was better, but two days later she had a chill. She had had no chills since then, but had sweat profusely at times and had lost much weight. The temperature had not been normal but once in the last two weeks, and had been very irregular. The food had been changed to a weak top-milk and barley-water mixture. She had not vomited, but had been constipated. The movements, however, were normal in character. The Widal reaction was negative. The diagnosis of malaria having been made, she had been given quinine in considerable doses during the last six days, without, however, any improvement in the symptoms. She was well developed and nourished and of fair color, but somewhat flabby. The physical examination, including the ears, was entirely negative. The white corpuscles numbered 37,600. The fresh urine was cloudy, pale, neutral in reaction, and contained a very slight trace of albumin. The centrifugalized sediment showed very many pus cells, free and in clumps, a few small, round, squamous, oval, and caudate cells, no casts, and many motile bacteria.

In this case, on account of the absence of urinary symptoms, the true condition had not even been suspected. Typhoid fever being excluded by the negative Widal reaction, an almost positive diagnosis of malaria had been made because of the fever, chills, and sweating. The failure of quinine to relieve the symptoms, however, then led to

[23] La Pediatria, 1903. (Quoted by Caccia.)

the suspicion that the diagnosis was wrong and that the baby had some other obscure disease.

CASE II.—A girl, aged five and one half months, that had been perfectly well, suddenly became fussy and began to cry out and to have a high fever. Physical examination was entirely negative except for very questionable reddening of one drum. Paracentesis was followed by no discharge and no relief of the fever and restlessness. She took her food fairly well and digested it perfectly. The temperature ran between 103° and 105° F. for eleven days, when it became very irregular, ranging from normal to 105° F. On one occasion there was a chill. Examination of the urine on the seventh day showed only bacteria, but on the fourteenth day it was full of pus. This was complicated by a non-purulent perinephritic inflammation requiring operation.

In this case, also there was nothing whatever in the symptomatology to draw attention to the urinary tract. Looking backward, however, it is evident that the pain from which the baby suffered was caused by the inflammation about the kidneys. The redness of the ear drum led me astray for several days, and then I did not appreciate the importance of the bacteriuria, not realizing at that time that simple bacteriuria may be accompanied by severe symptoms.

CASE III.—A girl, aged eight and one-half months, had been fed on home modified milk and had done perfectly well. Two weeks before she was seen the temperature suddenly rose to 104° F. without any apparent cause. The physical examination was negative. Her bowels were opened and she was given barley water and Mellin's Food. The temperature dropped to normal in about thirty-six hours, and remained there until the third day, when it rose again to 105° F. It then gradually fell to normal, went up again in four days, dropped to normal again in one day, stayed normal for two days, and went up to 104.8° F. again the morning she was seen. The physical examination had been entirely negative. She had refused her food on the days of fever, but had taken it well on the other days. She had not vomited. The movements were normal at first, but latterly had contained mucus. There had been a tendency to constipation. The bowels had been washed out almost every day. The washings apparently reduced the temperature. There had been no cough, no chills, and no cyanosis. She was well developed and nourished, but a little pale. The tonsils were a little large and the throat slightly reddened. The physical examination was otherwise entirely negative. The temperature was 102.8° F. The movements contained a good deal of mucus and were discolored with bismuth. The white blood count showed 51,700 leukocytes. The blood smears showed no malarial organisms and no changes in the red cells. The urine was cloudy and contained a large amount of pus.

In this case, too, there was nothing about the symptomatology to

direct attention to the urinary tract. The fever had been attributed to toxic absorption from the gastro-enteric tract because of the absence of physical signs, the mucus in the movements and the fall in temperature following irrigation of the bowels. The true condition had never been suspected.

CASE IV.—A boy, aged eight months, ran a high temperature from December 23 to January 2 without any other symptoms, except that he had an attack of cyanosis daily when the temperature was highest. Puncture of the ear drums had no effect on the symptoms, which ceased as they had begun without any apparent reason. He was well from that time until January 13, except for some flatulence and constipation. The temperature from that time until he was seen, January 17, had been under 102° F. until that afternoon, when it went up to 105° F. He had apparently had some pain in the abdomen, had taken his food rather poorly, and had been troubled a good deal by gas. The movements were normal. There had been no trouble in passing water. The physical examination was absolutely negative in every way. The white corpuscles numbered 14,400. The blood showed no plasmodia. The urine, however, was found to be loaded with pus.

There was nothing in this case, any more than in the others, to direct attention to the urinary tract. Otitis media was at first supposed to be the cause of the fever, but this explanation had to be given up when there was no relief from the paracentesis. Typhoid fever and malaria were considered as possibilities, but an intestinal toxemia was considered most probable until the urine was examined.

CASE V.—A girl, aged seven months, was taken suddenly sick with high fever the night of July 7. No cause could be made out. The temperature ran between 103° and 105° F. up to the time she was seen, July 14. The physical examination had always been negative. She had had a slight cough in the beginning. She had taken her food poorly, but had vomited but once. The bowels had moved regularly and the movements had been normal. She had always been conscious, but during the last two days had seemed tender all over and had held her head backward. During the last two or three days micturition had been painful and the urine had left greenish yellow spots on the diapers. She was well developed and nourished and of fair color. She was conscious, but irritable. She held her head backward, but the motions of the neck were not limited, and there was no tenderness of the neck. The physical examination was otherwise entirely negative. There was a small spot, looking like pus, on several of the diapers. The temperature was 103.6° F., the pulse and respiration were very rapid. The cerebrospinal fluid, obtained by lumbar puncture, was clear and under low pressure. Microscopic examination showed nothing abnormal. The urine contained much pus, an occasional cell, and many colon bacilli.

The importance of the painful micturition and of the greenish yellow spots on the napkins had been entirely overlooked, while meningitis was suspected because of the general tenderness and the retraction of the head.

CASE VI.—A boy, aged twenty months and previously well, had a moderately severe attack of acute intestinal indigestion early in September, from which he recovered quickly. About the middle of September he had an infectious diarrhœa from which he had practically recovered, when, on October 4, his temperature suddenly rose to 103.5° F., and micturition became painful. He retained his urine as long as possible, and screamed when it was passed. The temperature ran between 99° and 103.5° F. The urine had stained the diapers yellow. His appetite was fair and the movements normal. Physical examination on October 6 showed nothing whatever abnormal until the urine was drawn and examined. It was found to be very turbid and to contain large shreds. It was full of pus cells, single and in clumps, but contained no casts or squamous cells.

The symptoms pointing to the urinary tract were unusually prominent in this case. Their importance had not been appreciated, however, and they had been attributed to the intestinal tract, probably because of the previous diarrhœa.

CASE VII.—A boy, aged seven months, had always been breast-fed and had always been perfectly well. A month before a slight yellowish stain was noticed on a diaper wet with urine. The urine at that time was perfectly clear and the meatus clean. Two weeks later a similar stain was noticed on another napkin, and a week later the urine which was passed in the vessel contained a yellowish shred. This was examined microscopically and found to be composed of pus cells held together by a little mucus. From that time on the urine had contained pus. He had lost considerable color during the last two weeks and had gained little in weight; otherwise he had seemed well. There had been no increase in the frequency of micturition, no pain on micturition, no irritation about the meatus, and no urethral discharge. The physical examination was entirely negative, the temperature 99.4° F. An *x*-ray examination showed no stones in either kidney. The blood contained 8500 leukocytes. The urine contained a great deal of pus and many small round cells, but no tubercle bacilli.

In this case there was a deposit of pus on the napkins two weeks before the appearance of any constitutional symptoms. The importance of the yellow stain on the napkins was not appreciated, however, until the shred was noticed in the urine. It is noteworthy that there were no symptoms pointing to the urinary tract except the yellow stain on the napkins and the shreds in the urine. These would probably have been overlooked if the baby had not been the child of a physician.

PROGNOSIS. The prognosis as to recovery is very good, a fatal termination being very unusual. But one of my 50 patients died. In most cases, however, the duration is long. Some patients recover entirely in two or three weeks, but more drag on for several months in spite of treatment. Exacerbations are common and relapses not rare. Complications are most unusual.

TREATMENT. Local treatment of the bladder is, as a rule, not indicated and is of comparatively little value. The drugs most commonly used may be divided into two groups—the alkalies and hexamethylenamine and its compounds. Theoretically the alkalies should do harm rather than good because the colon bacillus grows more luxuriantly in alkaline or neutral than in acid media. Moreover, there is more opportunity for a concurrent infection with other bacteria if the urine is alkaline. Clinically, however, many cases improve rapidly and recover when the alkalies are given. In fact, it seems to me that more cases do well on the alkaline treatment than on hexamethylenamine.

Hexamethylenamine is by far the most powerful drug of its class, and should be used in preference to any of the others. It liberates formaldehyde readily, but slowly and persistently, in the urine and has a strong antiseptic action. Unfortunately, although I am unable to find any experimental evidence on this point, it is a well-established clinical fact that the colon bacillus is, as a rule, but little and often not at all affected by hexamethylenamine. Consequently much less is to be expected from it in diseases of the urinary tract when the infecting organism is Bacillus coli than when other organisms cause the trouble. Nevertheless many authors feel that they have obtained good results with it and recommend it highly. I have myself seen cases improve and recover while taking it, but, as I have just said, it does not seem to me to act as well as the alkalies. Salol is also recommended. Its antiseptic action is, however, much less powerful than that of hexamethylenamine. Abt has seen guiacol, in one drop doses, apparently help in obstinate cases.

Various attempts have been made to treat this condition with serums of one sort or another. Combe[24] gave 10 c.c. of the Celli-Valenti anticoccal serum on two successive days in one case, and thought that he got favorable results. Dudgeon[25] has used an anti-colon bacillus serum in 50 cases in adults, giving 25 c.c. on three successive days. He found it most useful in acute cases, not so useful in subacute, and useless in chronic cases.

Another method of treatment, which seems most rational, and which has recently come into use, is the subcutaneous injection of dead cultures of the colon bacillus, regulated or not by the opsonic

[24] Riv. di Clinica Pediatrica, April, 1904. Abstract in Brit. Jour. Child. Dis., 1904, i, 331.
[25] Lancet, 1908, i, 615.

index. Caccia in his experiments on agglutination in Bacillus coli infections never got heterogenous agglutination, but did get homologous agglutination in high dilutions, suggesting strongly that, on account of the various strains of Bacillus coli, little can be expected from any but autogenous vaccines. These only, therefore, should be used. I feel sure, from the very general use of vaccine therapy during the last two years, that many cases must have been treated in this way. I have not, however, been able to run across them in my search of the literature. Dudgeon, speaking from his experience in adults, says that they occasionally do good in chronic cases, that they make the patient feel better and raise the opsonic index, but do not influence the bacilluria. Reasoning from the action of vaccine therapy in other infections, more should be expected from it in chronic than in acute cases of urinary infection with Bacillus coli. My own experience with the vaccine treatment has been rather limited and, on the whole, rather disappointing. In some instances it has seemed to do good, in others not. In no case, however, has it done any harm, although in one the first injection apparently caused considerable depression. The following cases are examples of the treatment by this method.

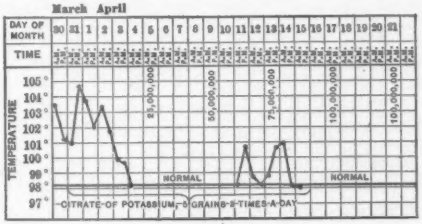

CHART VI.—Case VIII.

CASE VIII. No. 3148.—Female, aged sixteen months, began to be out of sorts March 26. March 29 she was feverish, drowsy, and had a cough. She was sent to the Infant's Hospital with the diagnosis of pneumonia. The physical examination on March 30 was essentially negative, except for a slight rhinitis and a mild catarrhal otitis media. These were quickly relieved by treatment. The urine was cloudy, acid, and contained a slight trace of albumin. The sediment was composed of pus with an occasional squamous cell. Citrate of potassium, 5 grains, three times daily, was begun on March 31. (Chart VI.)

April 1. The urine contained many motile bacteria, many pus cells, singly and in clumps, and an occasional small round and caudate cell. There was no pain on micturition. The temperature dropped to normal by a rapid lysis after the citrate of potassium was begun, reaching normal on April 4.

April 5. 25,000,000 dead bacteria from an autogenous culture of colon bacillus were injected.

April 7. Urine: pale, slightly cloudy, faintly acid, 1016, slightest possible trace of albumin. Sediment: a few small round cells, and an occasional motile bacillus but no pus. The bacterial injections were repeated at intervals of about four days. In spite of them, however, there were slight exacerbations of temperature on April 11, 13, and 14, at which time the citrate of potassium was stopped.

April 15. Urine: the sediment contained bacteria and an occasional squamous cell.

April 22. Urine: normal color, clear, acid, slightest possible trace of albumin, an occasional squamous cell.

The injections were controlled by the opsonic index in this case. It is very difficult to decide whether or not they did any good, because the temperature had fallen to normal before they were begun and because the citrate of potassium was continued afterward. It seems reasonable to suppose that the improvement would have continued as it had begun if they had not been given. Whether it would have been as rapid, it is impossible to state.

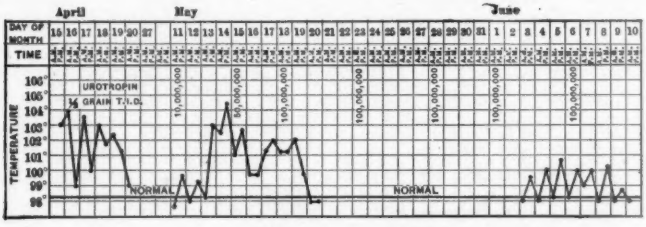

CHART VII.—Case IX.

CASE IX.—No. 2883. Female, aged eleven months, had a temperature between 104° and 105° F., was restless and cried a good deal April 4, 5, and 6. During the next week she refused her food and slept but little. She did not vomit and the movements from the bowels were normal. During the last three or four days micturition had been accompanied by pain and straining, and the napkins had at times been stained brown and had a foul odor. She was admitted to the Infants' Hospital April 15. The physical examination was essentially negative except for moderate pallor. (Chart VII.)

Urine: the odor was foul; it did not contain albumin. There was much sediment which was composed of pus, free and in clumps, an occasional caudate cell, and many bacteria.

The next day hexamethylenamine, one-half grain, three times daily, was begun. The temperature rapidly dropped, reaching normal April 20. The urine on this day was foul, turbid, 1010,

slightly acid. The sediment was much less and was composed of pus, with many small round cells and many bacteria.

April 27. Urine: slightly foul odor, much less turbid, 1010, acid, sediment slight. It contained a moderate number of leukocytes and many highly refractive small round cells.

The hexamethylenamine was then omitted. As the urine did not clear up entirely, an autogenous vaccine of an unusual variety of the colon bacillus was prepared.

May 11. Injection of 10,000,000 dead bacteria.

May 13. Urine: slightly foul, slightly acid, 1010, slightest possible trace of albumin. The sediment was composed of broken-up cells, pus, and bacteria. The temperature on the 13th rose to 103° F., and continued more or less elevated in spite of injections of 50,000,000 bacteria on May 15, and of 100,000,000 May 18. After this it dropped to normal, where it remained for some time.

May 17. Urine: foul, turbid, amphoteric, slightest possible trace of albumin, much degenerated epithelium, very few casts, many bacteria.

May 18: Urine: turbid and foul, slightly acid, slightest possible trace of albumin. Sediment composed of pus, broken up-cells, and many bacteria, but no casts. It will be noticed that the temperature rose and the condition of the urine became worse after the injections of bacteria were begun. On the other hand, however, the temperature dropped to normal and the urine began to improve while the injections were continued.

May 22. The turbidity of the urine was less.

May 28. The urine was slightly turbid, 1015, acid, no albumin, slightly foul odor. The sediment contained many less cells, fewer bacteria, and no casts. The injections were continued, but either in spite of, or on account of, the injections, the temperature was somewhat elevated between June 3 and 9.

June 9. Urine: pale, acid, 1010, no albumin, no sediment. In the centrifugalized sediment microscopic examination showed nothing except an occasional leukocyte.

The temperature did not rise again, and there was no return of the urinary condition. The injections in this case were not controlled by the opsonic index. The temperature had fallen to normal and the character of the urine was improving when the injections were begun. The temperature rose again and the character of the urine become worse after the first injections. These were continued, however, and the urine finally cleared and the patient recovered, whether as the result of or in spite of the injections it is not possible to say.

Case X.—No. 3232. Female, aged five months, was taken ill May 18 with a "cold on the chest." Since then she had been fretful and feverish and had had a slight cough, but had taken her food well. She had vomited once on May 23. The movements from

the bowels had at first been normal. She was said to have had a tender swelling on the right side of the abdomen May 22. She had strained and cried when the bowels moved during the last two or three days. The movements had been green and had contained curds and mucus. Micturition had been frequent and a yellowish stain had been noticed on the napkins. She was sent to the Infants' Hospital, May 25th, with the diagnosis of appendicitis or ileocolitis. The physical examination was negative. Nothing abnormal was detected in the abdomen. There was no tenderness over the kidneys. Urine: cloudy, acid, large trace of albumin, much sediment, consisting mostly of pus. It also contained an occasional red corpuscle, numerous caudate cells, a few small round cells, and much mucus. (Chart VIII.)

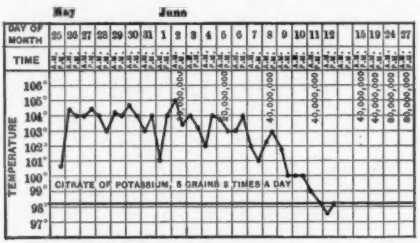

CHART VIII.—Case X.

May 28 she was given 5 grains of citrate of potassium three times daily; this was continued throughout her stay in the hospital.

June 1. Urine: acid, slightest possible trace of albumin, very many small round and pus cells, the pus being both free and in clumps, many motile bacteria.

June 2 she was given an injection of 10,000,000 dead colon bacilli, the vaccine being prepared from the organisms in her own urine.

June 5. Injection of 20,000,000 dead bacteria. Urine: high color, acid, very slight trace of albumin, very many pus cells free and in clumps, few small round cells, many bacteria.

June 7. The temperature dropped and there seemed to be some slight improvement in the general condition which, up to this time, had been poor.

June 8. Injection of 40,000,000 dead bacteria. This was followed by a further drop in the temperature and a rather rapid improvement in the general condition.

June 11. Injection of 40,000,000 dead bacteria. A drop of colon filtrate placed in the eye caused a purulent discharge.

June 12. The temperature reached normal the day before, and continued normal during the rest of her stay in the hospital. The urine contained much less sediment. This consisted of pus and

small round cells. The injections were continued, the amounts and dates of the injections being shown on the accompanying chart.

June 19 the urine showed about half as much sediment. This contained a very few small clumps of pus and an occasional scattered pus cell and small round cells with a few oval cells. There were many clumps of bacteria and a few motile organisms.

June 27. Urine much less turbid. The sediment contained many small, round cells, free and in clumps, an occasional leukocyte, many motile bacteria, and many clumps of dead bacteria.

June 28 she contracted measles and passed from observation.

In this case there was no improvement until the injections were given, although citrate of potassium was being taken. In fact, the general condition had grown steadily worse. Improvement was almost immediate after the injections were begun, and was continuous as long as the baby was under observation. It is almost certain that they did good in this instance. They were not controlled by the opsonic index.

My feeling at present as to the treatment is this: Alkalies are most likely to do good and should therefore be tried first. If there is no improvement while they are being given, hexamethylenamine should be used. If there is still no, or very little, improvement and the case is becoming chronic, autogenous vaccines should be tried. Circumcision should not be performed in these cases, as the resulting local reaction is liable to cause stasis and favor further infection (Rey[26]). In fact, two of the worst cases I have seen were the result of circumcision done while the infant was well.

THE DIAGNOSIS AND TREATMENT OF BILATERAL CYSTIC KIDNEYS, WITH SPECIAL REFERENCE TO THE DETERMINATION OF THE RENAL FUNCTION.

By Martin Krotoszyner, M.D.,
of San Francisco.

Prior to 1901, when James Israel's *Chirurgische Klinik der Nierenkrankheiten* appeared, only four authentic cases of bilateral polycystic degeneration of the kidneys in adults, correctly diagnosticated prior to autopsy or operation, had been recorded in the literature (Dugut, Verneuil, Stiller, and Lanenstein).[1] To this number Israel added four more cases, which he, too, was able to diagnosticate without resorting to the aid furnished by operative ocular inspec-

[26] Jahrb. f. Kinderheilk, 1901, liii, 648.
[1] Quoted from James Israel's Chir. Klin. d. Nierenkr., p. 542.

tion. The main reason for the failure to establish a correct diagnosis seems to be the absence of characteristic symptoms in many cases, until suddenly severe uremic symptoms set in and are quickly followed by the patient's death. I have seen a case of this type:

CASE I.—A woman, aged sixty years, was treated in the medical service of the German Hospital for gastric disturbances (frequent vomiting) which apparently did not yield to symptomatic treatment. Quite suddenly she became comatose. On the right side of the abdomen a large mass was palpable, which was thought to belong to the right kidney. I was asked to effect, if possible, cystoscopic separation of both renal secretions with a view to determine the kidney function, prior to the intended exposure of the right kidney. Upon examination I found the patient in deep coma. The very scanty urine gave a heavy cloud of albumin and contained numerous granular casts and degenerated epithelial cells. On the right side of the abdomen an irregularly shaped mass was palpable; it was movable with respiration, of hard consistency, had a nodular surface, and apparently represented the enlarged right kidney. The left kidney could not be palpated. While preparing the patient for cystoscopic examination, she had a violent uremic convulsion, owing to which the examination was deferred. A few hours later she died. The autopsy showed the typical picture of polycystic degeneration of both kidneys, hardly any normal kidney tissue being noticeable. The right kidney was considerably larger than the left, but that organ, too, was at least three times the size of a normal kidney.

Although, on account of abdominal tympanites, palpation was difficult, nevertheless, a mass the size of the left kidney should have been detected, if efforts at palpation had been made as persistently and systematically as on the right side, and if the probability of the affection being bilateral had been thought of at that time.

Unfortunately the clinical charts and records of this case, which was observed at the time of the great San Francisco earthquake and fire, were lost. But the lesson I learned from my brief observation at the bedside, and especially from the autopsy findings, were not forgotten, and aided me in the diagnosis of the following case:

CASE II.—A teamster, aged forty-one years, with a family history and a previous history of no importance, had at first, four years ago, experienced a rather sharp pain on both sides in the kidney region. The pain set in rather suddenly, was very severe, and at that time confined the patient to his bed for five days. After a year of apparently good health, during which time he followed his usual occupation, similar pain suddenly set in again. This time the patient was treated at a hospital for three weeks without much benefit, for he was still suffering from pain in both loins when he left the hospital. Gradually the pain decreased in intensity and the patient's condition improved to such an extent that he was able to resume his usual occupation for another year, when the pain set in again and

grew so unbearable that in December, 1907, he entered St. Mary's Hospital. Through Dr. T. E. Bailly, the attending surgeon's, kindness I was enabled to examine the patient, who at the time complained of continual pain in his back, general malaise, and great thirst. Repeated examinations of the urine revealed about the same findings as are generally present in chronic interstitial nephritis: large daily quantity, low specific gravity, traces of albumin, and microscopically small round epithelial cells and a few hyalin and granular casts. On both sides of the abdomen large irregularly shaped tumors of hard consistency were palpable; they moved with respiration, and apparently represented enlarged kidneys. Cystoscopy showed nothing of note in the bladder; ureteral catheterization had at that time to be deferred owing to the patient's extreme sensitiveness. The patient left the hospital a few days later, and at his home was seized with hematuria, which lasted several weeks. On January 9, 1908, he entered the German Hospital, where a systematic study of his case was made and where he remained until his death.

A careful general examination did not reveal anything of note, except an anemic murmur at the apex of the heart. The temperature ranged between 97° and 99° during the whole period of observation; the pulse varied between 80 and 100, except that toward the end of life it went gradually above 100. The urine analysis gave always the chemical and microscopic features generally observed in chronic interstitial nephritis. There were always a few red cells present in the microscopic slides examined. During the patient's stay at the hospital a marked hematuria of ten days' duration was observed; afterward the urine gradually cleared up again. Owing to the patient's great nervousness and his objections to cystoscopic examination, ureteral catheterization was performed on only two occasions. The first time the ureteral catheter entered the right ureter without difficulty, while the urine of the left kidney had to be taken from the bladder. Since, for obvious reasons, this method of separation of renal secretions is not absolutely reliable, only the urea content and the microscopic findings were determined at that time:

	Right kidney.	Left kidney.
	Per cent.	Per cent.
Urea	0.6	0.7
	Microscopically.	
	Many small round cells, blood shades, many bacteria.	Many red cells, pus cells, bacteria.

On February 17 both ureters were catheterized, but although the catheters were permitted to remain in situ for several hours, only a few cubic centimeters of urine was obtained, an amount too small to permit the performance of more than one functional test.

	Right kidney. Per cent.	Left kidney. Per cent.
Sugar (after phloridzin injection)	0.0	0.0
Urea	0.8	0.7
	Microscopically.	
	Blood cells, blood shades, urates.	Blood cells.

When, a few days later, the same amount of phloridzin (1 c.c. of a 0.5 per cent. solution) was injected a very slight sugar reaction with Fehling's test was obtained in the bladder urine ninety minutes after the injection. (1 c.c. of the same phloridzin solution injected at the same time in a man, aged seventy-one years, suffering from a papilloma of the bladder showed a very strong sugar reaction thirty minutes after injection.) The blood cryoscopy was —0.60.

In order to gain more reliable data upon absolute functional renal capacity, the daily amount of excreted urea was measured over a certain period, during which the patient was kept on practically the same diet. Below is given a table showing the daily amount of urine and the urea excretion for fifteen consecutive days:

1908	Urine quantity in ounces.	Urea per cent.	Total urea.
February 5	60	0.7	12.6
6	60	0.7	12.6
7	50	0.7	10.5
8	48	0.8	11.5
9	40	0.7	8.4
10	30	0.8	7.2
11	28	0.8	6.7
12	28	0.8	6.7
13	28	0.9	7.3
14	52	0.8	12.4
15	28	0.8	6.7
16	28	0.8	6.7
17	32	0.8	7.68
18	28	0.9	7.56
19	16	0.9	4.32
Average	37	0.8	8.64

Various blood examinations made during the time of continuous observation gave the following result: The hemoglobin decreased from 70 per cent. to 55 per cent. The color index varied between 0.74 and 0.88; the red cells decreased from 3,088,000 to 1,920,000; the white cells increased from 12,400 to 17,000; the various differential counts gave an average of about 75 per cent. of polymorphonuclears, about 10 per cent. of large mononuclears, 4 per cent. of small mononuclears, and 7 per cent. of eosinophiles.

The tumors on both sides of the abdomen grew rapidly in size. On February 2, 1908, the following notes were made: In the left hypochondrium a resistance is felt extending down to the line of the navel. On the right side a tumor is palpable, the lower pole of which

extends to 5 cm. above the umbilical line. Both tumors are of hard consistency and are nodular.

On February 15 the following note was made: On ordinary examination the mass on the left side is palpable at a line about 4 cm. to the left of the navel and extends downward to 1.5 cm. below the umbilical line. The tumor on the right side is smaller and extends to about 3 cm. above the navel. The surface of both tumors is irregular, protuberances the size of a walnut being felt. These protuberances are particularly marked on the right side. Both tumors move downward with respiration about 2 or 3 cm.

The patient became perceptibly drowsy the beginning of February, and drifted into a comatose state about the middle of the month. He vomited frequently. On February 19 he was restless and complained of severe pain in the region of both kidneys. On February 20

FIG. 1.—The enlarged left kidney, one-fourth actual size, of Case II.

he was in deep coma; did not urinate spontaneously; although 300 c.c. of urine was evacuated by catheterization. Marked symptoms of uremia (coma, vomiting, convulsions, almost complete anuria) developed, and with these symptoms he died February 26.

Of the autopsy, which was performed by Dr. Ophüls, only those notes are given which pertain to the kidneys and liver (otherwise nothing of pathological note was found):

The left kidney (Fig. 1) is tremendously enlarged (more than 12 times the normal size), and consists practically entirely of smaller and larger cysts. It weighs 4 pounds 2 ounces, and measures 23 x 13 cm. The right kidney (Fig. 2) is almost as large as the left, and presents the same picture. It weighs 2 pounds, and measures 20 x 10 cm. The cysts are partly filled with clear watery fluid, partly with a brown liquid, and partly with blood clots. The liver is of normal size, and

shows quite a number of small cysts, from 2 to 4 mm. in diameter, filled with a clear fluid.

A careful ocular inspection of both kidneys fails to detect any perceptible areas of renal parenchyma which might be supposed to be of appreciable secreting activity. It appears, therefore, almost inconceivable that the patient, without grave symptoms of disturbed metabolism, could carry on life until the rather sudden onset of renal insufficiency two or three weeks prior to death. Such an observation, though, proves once more the clinically important fact that infinitesimal areas of normally secreting kidney tissue, not noticeable to the naked eye, may suffice to maintain the renal equilibrium under normal conditions. Equally surprising is the fact that a man

FIG. 2.—The enlarged right kidney, one-fourth actual size, of Case II.

with both kidneys anatomically diseased and functionally incapacitated could for a long time do hard physical work with comparatively little disturbance of his metabolism. Although this patient's first symptoms date back four years, he was able to attend to his occupation as a teamster almost continuously until a few months prior to death. He had probably large cystic kidneys for many years before their presence was ascertained by palpation, a presumption which is based upon the knowledge that cystic degeneration of the kidneys is in most instances a congenital affection. Israel has also observed several cases which, from the time that the presence of bilateral cystic kidneys could be ascertained by palpation, went on for ten

years and more with comparatively few symptoms caused by disturbance of renal metabolism.

The literature contains but scant references upon absolute and relative functional capacity of bilateral cystic kidney. Casper[2] expresses the hope that most valuable diagnostic data would be obtained by systematic investigations in this direction. Kapsammer[3] considers our newer methods of testing renal function most valuable for those cases of suspected bilateral cystic kidney in which enlargement of both kidneys cannot be ascertained by palpation, and in which bilateral functional renal depreciation points to the probable diagnosis of cystic kidney. Steiner[4] applied in one case in Israel's clinic the test of determining absolute urea excretion, and found abnormally large amounts (over 36 grams in twenty-four hours). In my case the daily average output of urea (8.6 grams) was far below that generally considered normal. These findings are the more significant, since they coincide with the low point of blood cryoscopy (—0.60) and especially because they are in accord with the comparative values of urea excretion found in the separated renal secretions (0.8 on the right, and 0.7 on the left side).

Since in cystic kidney, as a rule, we have to deal wth a bilateral affection, it stands to reason, that the determination of absolute or total renal function is as valuable if not more important than that of relative or comparative renal capacity. The determination of the twenty-four-hours urea quantity was always considered a more or less reliable index of absolute renal function. It is generally believed that normally functionating kidneys excrete a certain daily amount of urea (20 to 30 grams). We are, therefore, justified in assuming a lessened renal function from the inability of the kidneys to excrete waste products of metabolism in sufficiently large quantities. It must be admitted, though, that the determination of the twenty-four-hour urea, done but once, is more or less valueless, since urea excretion varies considerably under normal conditions, and the test itself is not scientifically accurate unless exact quantitative chemical determinations of ingesta and excretions over a certain period of time are carried out, which, for obvious reasons, is not a feasible routine bedside procedure. Nevertheless, if the test is carried out over a certain period of time, during which the patient is kept under strict observation in bed and on the same diet, the test for practical purposes is sufficiently accurate to permit reliable conclusions. Innumerable observations have proved that, other things being equal, 20 to 25 grams represent the average daily urea excretion of healthy kidneys. A decrease to over half the average normal quantity, therefore, would point to renal insufficiency, and in this case, was regarded as a contra-indication to operative interference.

[2] Lehrbuch der Urologie.
[3] Nierendiagnostik und Nierenchirurgie, ii, 301.
[4] Loc. cit., p. 545.

I am glad to see that Kümmell[5] too, is in the habit of applying the absolute urea test in a similar manner upon his large material of surgical kidneys prior to every intended operation. If the urea test applied over several days in the average coincides with a low point of blood cryoscopy, an operation, in Kümmell's opinion, is contra-indicated. An average daily urea excretion below 15 grams, according to Kümmell's experience, points toward a grave renal functional incapacity and forms as strong a contra-indication against an operative procedure as a low point of the more exact method of blood cryoscopy. Personally, I think that the urea test as carried out in this case is, as an indication of absolute normal function, more reliable than blood cryoscopy, which has disappointed most observers except Kümmell. I will concede to Kümmell, though, that the urea test gains in significance if it coincides with that of blood cryoscopy.

The third absolute functional test, the determination of phloridzin glycosuria in the mixed or bladder urine, was applicable in this case on account of the complete absence of sugar from both renal urines. It is well known that occasionally absence of phloridzin glycosuria in otherwise functionally normal renal urines occurs, and in the majority of instances is due to technical errors (old phloridzin solution, failure of heating the phloridzin properly, etc.), although some failures of obtaining positive results after injection of phloridzin as recorded in the literature (Israel and others) are not explained. These objections, though, are obviated by the positive result of the control test, and, therefore, the test as carried out in this case proves a marked depreciation of renal function by the belated appearance of a very faint positive reaction.

Since I was not able to obtain sufficient amounts of separated renal secretions for urine cryoscopy (10 c.c.), I had to content myself with the comparative phloridzin and urea tests. Both of them pointed likewise to an advanced renal insufficiency. The absence of phloridzin glycosuria alone, according to the experience of many observers, points to a functional renal insufficiency of such an advanced degree as to designate any operative interference a fatally hazardous risk. It is important, though, in order to gain a clear picture of the renal function in a given case, to perform several tests for absolute as well as relative renal capacity, since in the coincidence of these tests lies the reliability of the method. If the absolute tests, as in this case, are equally high or low among themselves, and if, as a whole, they correspond with the relative tests, we are able to draw fairly accurate conclusions, not only upon absolute renal function, but also upon the functional value of each kidney separately—for the real value of all functional tests, when combined, lies in their enabling us to formulate a reliable vital prognosis, and especially in offering us strict indications and contra-indications for treatment.

[5] Zeitschr. f. Urologie, ii, 3 and 4.

Whether to operate at all in a case of bilateral cystic kidney, which of the two diseased organs to expose first for relief of pressure and other distressing symptoms caused by large cysts, or whether nephrectomy, if otherwise indicated, should be attempted—all these questions can be answered with more or less accuracy by a careful study of the various functional tests in combination with the microscopic examination of the separated renal secretions.

In this case all functional tests pointed to such an advanced bliateral renal insufficiency, that an operative interference appeared to be contra-indicated. According to Kümmell and Graef,[6] Lund,[7] and others, excruciating pain, profuse hematuria, and very distressing symptoms caused by the presence of enormously large tumors would in exceptional cases be considered as indications for operative procedures (nephrotomy; puncture of the cysts, and packing of the larger cyst walls with gauze; nephropexy). None of these symptoms existed in this case to make an operation desirable, and, considering my patient's low renal function, I doubt whether the presence of one or more of these symptoms would have induced me to perform a hopeless operation. From this standpoint the value of our newer methods of renal diagnosis (ureteral catheterization and application of functional tests) as regards prognosis and treatment cannot be overestimated.

A word must be added in regard to the differential diagnosis. Malignant tumors, hydronephrosis, and echinococcic cysts of both kidneys had to be considered. Bilateral malignant kidney tumors (hypernephromas) are extremely rare. Malignancy does not lead to as enormous enlargement of both kidneys as does cystic kidneys, because in the rare instances in which malignancy on both sides has been observed, the second kidney became involved only a long time after the first. Palpation of hydronephrotic sacs gives characteristically smooth tumors, or, if they are irregular, equally large and flat protuberances can be felt, which are distinctly different from the unequal gibbus-like protuberances of cystic kidneys. Bilateral echinococcic cysts are extremely rare (only one such case having been observed) and give about the same palpatory results as hydronephrosis.

If, therefore, the symptoms and course of this case permitted from the start an exact diagnosis, and did not leave much doubt as regards the rational treatment, a third case, on the other hand, offered many unusually perplexing features, which made a correct diagnosis well nigh impossible and presented interesting problems as regards treatment.

Case III.—In April, 1906, I was asked by Dr. T. E. Bailly to examine a young woman, aged twenty-eight years, with the following

[6] Handbuch d. prakt. Chir., 1907, iv.
[7] Jour. Amer. Med. Assoc., August 18, 1906.

history: Her father died at the age of forty-three years from inflammation of the bowels; her mother is sixty-two years old and healthy; one brother is alive and healthy. The patient menstruated first at the age of fifteen years; menstruation has always been painful. Since early childhood she has had to urinate very frequently. About ten years ago she had painless hematuria, which lasted three days and has never returned. She has been married six years, and has no children. Of late she has suffered from severe dysmenorrhœa, for which curettage was performed about two years ago. Two months after this operation the patient was seized one night with very severe pains in the left loin, followed by high fever and general malaise. Her physician at that time informed her of the presence of a large floating kidney on the right side. The patient did not improve under symptomatic treatment, and was, therefore, sent to St. Mary's Hospital, where Dr. Bailly observed an irregular septic temperature, cloudy urine containing albumin and pus in abundance, but no tubercle bacilli. On the left side a mass was palpable, the exact outlines of which could not be made out satisfactorily owing to the patient's extreme sensitiveness. The right kidney was not palpable. There was frequent and very painful micturition. I was asked to perform cystoscopy, which revealed a severe cystitis and many ulcerated areas on the bladder wall. Catheterization of the left ureter was very difficult, as the ureteral os on that side was embedded in ulcerated tissue; the ureteral catheter readily entered the right ureteral orifice, which appeared to be normal. The separated kidney secretions showed macroscopically on the right side clear, and on the left side cloudy urine. The functional tests showed on both sides good values comparatively and absolutely, and the microscopic examination revealed on the left side the presence of pus cells in abundance and many blood cells, while the findings on the right side did not present anything of pathological note. This examination took place on April 16, 1906, and a report upon the findings was sent Dr. Bailly on the evening of April 17, the night before the great San Francisco earthquake. My own notes on this case were destroyed by the fire following the earthquake, and the report sent to Dr. Bailly by mail was likewise lost. This explains the failure of presenting exact data upon the functional and microscopic findings. In my opinion, communicated to Dr. Bailly, the patient was suffering either from an infected hydronephrosis or pyonephrosis on the left side. I advised, on account of the ascertained good function of the left kidney, against nephrectomy, which, as was pointed out, would only be indicated in case the inoculation test (guinea-pig) with the urine of the left kidney should reveal tuberculosis of that organ.

On account of the patient's grave general symptoms, Dr. Bailly, a few days later, opened from the loin by a left-sided nephrotomy a large suppurative cyst and drained through the incision. On the surface of the kidney several smaller cysts were noticed, and

were punctured. The operation had to be performed rapidly and under very awkward conditions in an overcrowded Oakland Hospital (St. Mary's Hospital having been destroyed by fire). The patient after the operation was for many weeks in a very precarious condition, which Dr Bailly ascribed to his failure to remove the left kidney. A renal fistula persisted for several months, but, however, finally closed. Before leaving the hospital the patient underwent a laparotomy under general anesthesia for ventrofixation of a retroflexed uterus. She recovered rapidly from this operation and left the hospital in October, 1906, in a fairly good condition, her only complaint at that time being frequent micturition and, at times, urinary incontinence.

The patient was sent to me again for examination in December, 1907. She suffered from headache, severe backache, and general malaise during the last six months. She urinated every hour during the day and once or twice during the night. The kidney on the right side was enlarged and easily palpable, the kidney on the left side also appeared to be larger than normal upon palpation. Cystoscopically the bladder showed the picture of an old cystitis, areas of scar tissue here and there in the trigone, but nowhere in the bladder were ulcerations noticeable. Both ureteral orifices appeared normal and were easily catheterized. Clear, straw-colored urine was collected from both sides. The analysis was as follows:

	Right kidney. Per cent.	Left kidney. Per cent.
Urea	1.5	1.1
Δ	—1.8	—1.5
Sugar (after phloridzin)	0.28	0.18

Microscopically.

Small round cells (pear- and spindle-shaped prevalent); red cells (in moderate amounts); pus cells (frequently in groups).	Small round cells (often in groups); red cells (abundant); blood shades; no pus cells.

The daily amount of urine was about 2000 c.c. The patient noticed an increase in the daily amount after the ureteral catheterization. Her headache improved since that time. *X*-ray plates showed the outline of large kidneys on both sides, while no characteristic shadows of calculi were visible.

The patient was seen again on April 14, 1908. She stated that headache and backache had gradually increased in intensity, so that life appeared almost unbearable. There was general malaise, and she was unable to work. She urinated about 100 c.c. every two hours during the day and twice during the night, and suffered tenesmus in the bladder at the end of urination. On palpation the right kidney appeared greatly enlarged, its surface irregular and nodulated; its lower pole was palpable at the navel line on ordinary respiration, while it was felt 5 cm. below the umbilical line on deep

inspiration. The left kidney was palpable, but did not appear to be perceptibly enlarged nor tender to the touch.

Cystoscopy: The second washing returned clear. The bladder wall and ureteral orifices were almost entirely normal. Both ureters were readily entered. The urine was clear on both sides. Both urines gave a positive sugar reaction after phloridzin injection. The urine in appreciable quantity was only obtained from the left side at this sitting, and all attempts to obtain sufficient urine for functional tests from the right side were futile. Therefore, cystoscopy was repeated two days later. Again, too little urine was obtained from the right side for the performance of more than one functional test and for comparative microscopic examination:

	Right kidney.	Left kidney.
	Per cent.	Per cent.
Urea	0.02	0.009
	Microscopically.	
	Blood cells; pear-shaped kidney cells; calcium oxalate crystals.	A few blood cells; a few pus cells; a few small round epithelial cells.

From the standpoint of differential diagnosis, renal neoplasms (hypernephroma), cystic kidney, and hydronephrosis on the right side had to be considered. The formation of a hydronephrotic sac in the dislocated right kidney seemed to be the most probable diagnosis, although the palpatory evidence (nodulation) did not support this presumption. Owing to the good functional capacity of the right kidney, which was also comparatively superior to that of the left organ, the removal of the right kidney was advised only as an extreme measure in case that organ should be found to be the seat of a malignant neoplasm.

FIG. 3.—Two cysts, two-thirds actual size, removed from the right kidney of Case III.

April 23, 1908. Operator, Dr. Bailly. The right kidney was exposed by a lumbar incision. The fatty capsule appeared to be very much thickened. The greatly enlarged organ was brought to the surface with great difficulty, and presented the typical picture of cystic kidney, the whole organ being studded with cysts of sizes from a walnut to a pinhead (Fig. 3). The largest cyst, which ex-

tended from the centre to the upper pole of the posterior surface and revealed a turbid, mucopurulent fluid, was evacuated. From all other cysts a clear watery fluid flowed upon puncture. When the kidney was divided, it presented on both cut surfaces numerous larger and smaller cysts, which were carefully evacuated. Very small islands of apparently normal kidney parenchyma seemed to be left after evacuation of all macroscopically noticeable cysts. All larger cystic cavities were packed with vioform gauze, and the kidney was sutured at both poles with a few deep catgut sutures. The final steps of the operation were decapsulation and nephrofixation, and drains to the kidney pelvis and from the upper and lower kidney poles through the incision.

The patient rallied comparatively quickly from the operation. On the second day after the operation the bandages were soaked with urine. A rather alarming hemorrhage occurred when the gauze drains from the cut surfaces of the kidney were removed. The patient urinated spontaneously about 1200 c.c. of urine daily, and nineteen days after the operation had an almost normal temperature and a strong pulse of about 100. The wound was practically closed about one month after the operation, while a small fistula in the centre of the incision was closed about a month later.

September 16, 1908. The patient appears again for examination. She has gained in weight and strength, and is able to be about. Her only complaint is a rather severe and annoying backache. The urine is clear, of amber color, 1012 specific gravity, of acid reaction; it contains microscopically many bladder cells, a few round epithelial (kidney) cells, a few pus cells, and some uric acid crystals. The kidneys are not palpable. Cystoscopy: The bladder wall is entirely normal except the trigone mucosa, which is slightly congested. Both ureters being catheterized, sugar appears on both sides almost simultaneously twenty-six minutes after the injection of 2 c.c. of phloridzin solution. Blue colored urine appears almost simultaneously from both sides fourteen minutes after the injection of 4 c.c. of a 4 per cent. indigo-carmine solution. The comparative functional tests give the following results:

	Right kidney.	Left kidney.
Albumin	Very slight trace	Present
Urea	0.01	0.008
Δ	—1.0	—1.1
Sugar	0.2	0.23

March 3, 1909. The patient's general appearance is excellent; but she complains of lack of strength and backache; she is not able to do her housework. The lower pole of both kidneys is palpable. She urinates every four hours during the day and once or twice during the night. The daily amount of urine is about 1500 c.c.; it is clear, straw color, has a specific gravity of 1016, and contains a faint trace

of albumin and a few leukocytes, flat and round epithelial cells, and many bacteria. The patient cannot be persuaded to submit to cystoscopy and ureteral catheterization for determination of the renal function.

This case represents the not very rare type of bilateral cystic kidney, in which the cystic degeneration of one kidney is followed after a long time by involvement of its sister organ, so that a tumor was palpable on one side (left), while palpation on the other (right) side gave a negative result. This phenomenon alone made the diagnosis a very difficult task. The evacuation of a large suppurative cyst on the left side reduced that organ to almost normal size, while the increase in size of the right kidney made its palpation possible only during the few months prior to operation. The case further proves the value of determining comparative kidney function. If the left kidney had been removed—and its removal was only prevented by the fact that its functional value was found to be good and comparatively even better than the right organ—the operation which later had to be done on the right side would have been a more hazardous if not a prohibitive procedure.

Jändler[8] describes the case of a woman, aged forty-four years, in whom a cystic kidney on the right side, erroneously diagnosticated as a malignant tumor, was removed. Shortly after the patient had recovered from her nephrectomy, uremic symptoms set in and were followed by complete anuria. The left kidney, at that time, proved upon palpation to be as large as a child's head; its exposure revealed a typical cystic kidney, which was divided down to the pelvis; all cysts were evacuated and the patient made a good recovery for the time being. Bardenheur[9] successfully removed a cystic kidney which was the seat of a large pus cavity, although the other kidney was known to be probably cystic.

The mortality of nephrectomy for cystic kidney is very high. Sieber[10] has collected 213 cases of cystic kidney; in 62 nephrectomy being done, gave a mortality of 32.8 per cent. Küster[11] records a mortality of 21 per cent. among his nephrectomies for cystic kidney, while Newman's[12] statistics show a mortality as high as 37.5 per cent.

The majority of authors, therefore, advise against nephrectomy in cystic kidney. Paul Wagner[13] considers nephrectomy in apparently unilateral cystic kidney indicated only in those cases in which by the various functional tests, after bilateral ureteral catheterization, good function of the apparently normal organ has been proved, and in which, besides, by direct inspection and palpation of the exposed

[8] Würzburger Dissertation, 1894.
[9] Mittheilungen a. d. Grenzg. d. Med. u. Chir., 1900, vi.
[10] Deut. Zeitschr. f. Chir., 1905, lxxix.
[11] Nierenchirurgie, 1902.
[12] Glasgow Med. Jour., 1889, xxxi.
[13] Handbuch d. Urologie, 1905, ii.

and supposedly healthy organ, the absence of cystic degeneration has been demonstrated. On account of the ever-present danger of cystic degeneration of the other kidney, which may occur at a later period, Küster[14] considers the removal of a cystic kidney contra-indicated in every instance, even if the other kidney, for the time being, is found to be anatomically and functionally intact, a view which is also expressed by Garré and Ehrhardt.[15] Kapsammer[16] is almost the only authority who advises nephrectomy in unilateral cystic kidney, for it is possible, he reasons, that the removal of one cystically degenerated kidney may prevent a similar retrogression of its sister organ. This theoretical presumption should not militate against the more conservative course of nephrotomy which, as my last case demonstrates, proved to be the means of saving the patient's life.

On account of the frequently fatal outcome of nephrectomy, attempts have been made of late to relieve symptoms by less severe procedures. Tuffier[17] performed partial nephrectomy in one case with an apparently satisfactory result up to the time of publication (two years after operation). Repeatedly nephrotomy with drainage, in a similar manner as on the left side in my third case, has been done, and been followed by relief of symptoms. Edebohls[18] performed decapsulation in a case of bilateral cystic kidney complicated by chronic nephritis, which was followed by rapid improvement of symptoms.

In my third case the operation performed on the right side was that first practised in two cases by Curtis and Kammerer[19] and also successfully carried out in one case by F. B. Lund.[20] The kidney is incised, the walls of the larger cysts are broken down, and the depleted organ sutured to the lumbar muscles.

Küster[21] has proposed a similar procedure; he advises cutting away with scissors so much of the cystic walls as to prevent their being again filled with fluid. Paul Wagner[22] warns against this and Lund's or Kammerer's procedure on account of the inclination of cystic kidneys to septic processes. In my own case a septic temperature set in immediately after the last operation and necessitated the removal of the gauze pack much earlier than was intended; this procedure also was attended by an alarming hemorrhage.

From my own observations and after a careful perusal of the literature on the subject, I must endorse Sieber's[23] dictum: "If we consider everything that is said and written upon operative proced-

[14] Loc. cit. [15] Nierenchirurgie, 1907. [16] Loc. cit.
[17] Garré and Ehrhardt's Chirurgie, p. 303.
[18] Zentralbl. f. Chirurgie, 1903, xxx, 39.
[19] Annals of Surgery, 1901, xxxiv, 419.
[20] Loc. cit. [21] Loc cit.
[22] Die Fortschritte in d. Behandlg. d. soliden u. cystischen Nieren.- u. Nebennieren-tumoren, Folia Urologica, January, 1908.
[23] Loc. cit.

ures in cystic kidney and the results of these operations, we must again and again warn against unnecessary operations. Only strict indications which are a menace to life should force upon us the necessity of an operation, which ought to be as conservative as is consistent with the condition found at exposure of one or both kidneys."

CONCLUSIONS. 1. Polycystic degeneration of the kidneys is in almost all instances a bilateral affection. In cases in which, for the time being, one kidney appears to be anatomically and functionally healthy, an involvement of this organ may be expected to develop later.

2. Determination of the kidney function is indispensable prior to decision upon any operative procedure.

3. Nephrectomy in cystic kidney is always contra-indicated.

4. Excruciating pain, general sepsis caused by suppuration of cysts, profuse hematuria, and distressing symptoms due to the presence of enormously large cysts are, under favorable conditions (good renal function), indications for operative interference.

5. Nephrotomy with puncture of cysts, decapsulation, and nephrofixation are the operative procedures which in selected cases may give satisfactory (temporary) results.

In conclusion, I wish to thank Dr. T. E. Bailly for the opportunity to observe and the permission to report Cases II and III.

THE VALUE OF THE WASSERMANN REACTION IN CARDIAC AND VASCULAR DISEASE.

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THE importance of syphilis as an etiological factor in the causation of arterial disense has been appreciated manv a year. Ambroise Paré, Morgagni, and Virchow insisted on this relationship. More recently Heller and Doehler have shown that the larger arteries, particularly the aorta, exhibit special changes due to syphilis. Heller thought these changes to be miliary gummas in the aorta, the changes occurring chiefly in the adventitia and media, and suggested that the process be designated as a mesaortitis syphilitica. Chiari preferred to speak of it as a mesaortitis productiva.

The same relation that exists between syphilis and aortic disease

has also been claimed for aneurysm. Many of the physicians of the seventeenth century were so much impressed with the importance of syphilis in the production of aneurysm that they described a special variety to which the name Venereal Aneurysm (Lancisi) was given. The later studies on mesaortitis syphilitica have substantiated these earlier views. But it has always been unfortunate that in encountering a case of aneurysm or of aortic disease occurring in middle or in late adult life, it was impossible to determine from a consideration of the clinical facts whether or not these conditions were of syphilitic origin, even though all other common determining causes of the disease were absent. If we conceive that endarteritis syphilitica is a common occurrence in the aorta, we may readily understand how gummatous changes in the tunica media may give rise by slow stages to the development of an aneurysm.

It has been customary, if not universally prevalent, to treat aneurysms by the administration of iodide of potassium. From a careful study of the later manifestations of constitutional syphilis, particularly as they affect the vascular and nervous systems, we are convinced that in these conditions the iodides are of very little avail, except that they may aid in the absorption of the gummatous thickenings. On the other hand, we are equally impressed with the fact, gained by experience, that for these late manifestations of syphilis, mercurial treatment is our chief reliance. Everything points, therefore, to the importance of finding corroborative evidence for the suspicion that in any given case of cardiac or vascular disease syphilis has been the most important factor. The uncertainty of former years has been replaced by the gratifying results obtained by recent serodiagnostic methods. The Wassermann reaction, if positive, proves with considerable accuracy that an active syphilitic poison is still circulating in the system. We were glad, therefore, to follow the lead of Julius Citron[1] in determining by this method the frequency of syphilis in cases of aortic insufficiency; but instead of limiting our inquiry to this one form of vascular disease, we have included aneurysms and other cardiac and arterial conditions. During the past winter such tests have been made upon cases that have come into the general medical service of one of us at the City Hospital, and into the neurological and medical service of the other at Mount Sinai Hospital.[2]

As for the method pursued in these tests, Dr. Sachs, in association with Dr. Castelli, has adhered to the classic form of the test as it is now practised in Berlin by the Wassermann school, the only variation from the original method consisting in the substitution of an alcoholic extract of the liver of a syphilitic fœtus for the aqueous

[1] Berl. klin. Woch., 1908, No. 48.

[2] Dr. Sachs wishes to express his indebtedness to Drs. Rudisch, Manges, and Brill for their courtesy in aiding him in this inquiry.

extract. All the precautions insisted upon by the Wassermann school were practised and the quality and strength of the reagents were tested in every series of examinations; control tests were instituted liberally, so that we are willing to vouch for the accuracy of the results. The Wassermann reaction, cumbersome as it may seem,

Number.	Initials.	Age.	Character of lesion.	Specific etiology known.	Wassermann reaction.	Remarks.
1	S. (male)	42	Aortic insufficiency	No	Negative	Two tests made
2	U. (female)	30	Aneurysm of aorta	No	Positive	
3	Bertha D.	18	Congenital heart disease, mitral stenosis, and insufficiency	No	Positive	Secondary chronic endocarditis
4	John S.	..	Aortic stenosis and insufficiency	No	Positive	
5	Jennie H.	20	Mitral stenosis	No	Positive	
6	Gussie N.	40	Chronic endomyocarditis	No	Negative[3]	
7	Nathan, E. C.	47	Angina pectoris	No	Weak positive	Noguchi test negative
8	Benjamin P.	..	Aortic stenosis and insufficiency	Yes	Positive	Tertiary lues; sudden death
9	Albert D.	41	Arteriosclerosis	Yes	Positive	
10	Esther G.	55	Diabetes and mitral stenosis	No	Negative	
11	Mary B.	..	Chronic mitral endocarditis	No	Negative	
12	S.	30	Aortic and mitral stenosis and insufficiency	No	Weak positive	In hemiplegia
13	Carrie B.	..	Mitral stenosis	No	Negative	
14	Robert J.	..	Mitral stenosis	No	Negative	
15	Mary F.	66	Aortic stenosis and insufficiency	No	Positive	
16	Robert T.	53	Aneurysm of aorta	Yes	Positive	Confirmed by autopsy
17	McG. (male)	40	Aortic insufficiency	No	Weak positive	
18	P. (male)	64	Mitral and aortic stenosis	No	Negative	
19	W. (male)	..	Tabes and aortic insufficiency	Yes	Positive	
20	Michael O.	37	Aortic insufficiency	Yes	Strong positive	
21	B. (male)	49	Aortic insufficiency; tabes dorsalis	No	Strong positive	
22	William C.	50	Aortic insufficiency	Yes	Weak positive	Confirmed by autopsy
23	John N.	70	Mitral insufficiency	No	Negative	Confirmed by autopsy
24	Mary C.	49	Aortic and mitral stenosis and insufficiency	No	Positive	
25	C. (male)	54	Tabes and aortic insufficiency	Yes	Positive	Second test after prolonged treatment; weak positive
26	L. (male)	24	Aortic insufficiency	Yes	Positive	Symptoms of cerebral lues
27	J. L. (male)	58	Aortic and mitral insufficiency	No	Weak positive	
28	M. (male)	42	Aortic insufficiency	Yes	Positive	Reaction negative after protracted treatment
29	Walter E.	24	Aortic insufficiency	No	Positive	Death; no autopsy
30	Philip L.	60	Aneurysm of aorta	Yes	Strong positive	
31	Sadie M.	45	Mitral stenosis	No	Negative	
32	Z. (male)	45	Aneurysm of innominate artery	No	Strong positive	
33	Mary N.	32	Mitral stenosis	No	Negative	
34	Adam Y.	32	Mitral stenosis and insufficiency	No	Negative	
35	Edward J.	55	Arteriosclerosis; aneurysm of aorta	Yes	Strong positive	
36	M. (male)	67	Aortic and mitral stenosis and insufficiency	No	Negative	

[3] Even at autopsy the syphilitic nature of disease was suspected, but could not be proved; the Noguchi test was also negative.

and demanding much time and patience on the part of the examiner, has, after all, stood the test of several years, and the results obtained by this method have been universally accepted. The few exceptional and contradictory findings, particularly in some acute infectious diseases, which have been published do not militate against the worth of the method in the vast majority of cases of syphilitic origin.[4]

We were interested chiefly, however, in the clinical facts, and in order to avoid criticism it seemed best in this study to adhere strictly to the original Wassermann technique. These cardiac cases constitute only a part of over 250 cases examined by us by the Wassermann method, and basing our opinion on this larger experience, we are persuaded that a positive Wassermann reaction implies active syphilis. Negative findings are not so significant. In spite of a negative reaction, active lues may exist, and yet we doubt whether this is frequently the case. When a negative reaction follows upon a positive reaction in the course of antisyphilitic treatment, a negative reaction signifies a gradual disappearance in the system of an active luetic poison. So much for the method and for the deductions to be made therefrom.

Returning to the consideration of cardiac and vascular conditions, we may note, first of all, that we have had five cases (II, XVI, XXX, XXXII, XXXV) of aneurysm, four of the cardiac aorta, and one of the innominate. The Wassermann reaction was positive in each of them. Two of these five patients admitted having had syphilis, two denied it, and one had had chancroid. If the test is reliable as indicating the existence of syphilis, it is seen how little importance is to be given to the patient's denial of the infection. This series is a relatively small one, and we are not willing to infer that a positive reaction will be found in all cases of aneurysm. On the other hand, there are cases in which the physical signs as well as symptoms indicate the existence of aneurysm, and in which the occurrence of a negative Wassermann reaction leads to some doubt as to the accuracy of the diagnosis. This was so in the case of a physician, aged fifty years, who, when he was thirty, contracted syphilis. He was treated by a prominent syphilologist in the city where he lived, and was pronounced cured. Every year after that time, until the onset of his present symptoms, he took iodide of potassium for some weeks. About ten years ago he began to have abdominal pain. Failing to get relief he had a laparotomy done. This revealed the existence of a kink of the colon. After the operation he was free from pain for some years. Two years ago he began to have pain in the back,

[4] At a later period one of us will have occasion to refer to some of the modifications of this method which have been proposed. Incidentally, however, we may refer to the fact that in a series of forty-five cases examined by Drs. Castelli and Sachs, according to the old method, and by Dr. Noguchi, according to his new method, the results were in almost entire agreement; so that there is little doubt that Dr. Noguchi's method will prove a most welcome addition to the serodiagnostic procedures.

which was often so intolerable that morphine had to be given. A diagnosis of aneurysm had been made, but the negative reactions to the Wassermann test had much weight in deciding against that diagnosis.

It is generally admitted that incompetency of the aortic valves is sometimes, perhaps frequently, due to syphilis, that is, to a syphilitic endocarditis, and there is no doubt that degeneration of the myocardium is likewise the result of the same infection. Adler[5] has insisted that syphilis should be considered a possible cause in every case of heart disease, and has also uttered the warning that in every case of syphilitic infection the heart should be carefully investigated. Realizing the rarity of gumma of the myocardium and of sclero-gummatous arteritis, he has dwelt upon the necessity of recognizing syphilitic myocarditis, that is, a primary interstitial myocarditis associated with panarteritis. He has cited the histories of several patients who recovered under rigorous antisyphilitic medication.[6]

The question that confronts us as practising physicians is, Can we distinguish cases of endocarditis or of myocarditis of syphilitic origin from those due to other causes? Until the advent of the Wassermann test the only way of determining this was by the results of treatment. From empiric knowledge the syphilitic cases could be suspected; neither from symptoms nor physical signs could it be said that the heart lesion was of syphilitic origin. A case of aortic incompetency of rheumatic origin presents the same clinical signs as does one of syphilitic. We are therefore unable to determine from a consideration of the clinical facts alone whether or not specific medication should be employed. When such doubt exists the Wassermann test will be of greater value to us, for although the absence of the Wassermann reaction does not disprove the existence of syphilis, its presence certainly justifies antisyphilitic medication.

Among the cases studied by us there were thirteen (I, IV, VIII, XV, XVII, XIX, XX, XXI, XXII, XXV, XXVI, XVIII, XXIX) in which the disease was limited almost entirely to the aortic valve. In 92 per cent. of cases of aortic disease a positive reaction was obtained; in 77 per cent. it was strongly positive. Citron found this to be the case in 62.6 per cent. of his cases. In his and in our own series the percentages are so high that one cannot doubt the importance of syphilis as an etiological factor in the causation of this condition. Of these 13 subjects, 8 acknowledged a previous specific infection; in the other 5 it was either unknown or denied. We have had 5 cases (Nos. XII, XVIII, XXIV, XXVII, XXXVI) in which there was both aortic and mitral disease. In this series there was one positive, 2 weakly positive, and 2 negative reactions. This proves that

[5] New York Med. Jour., October 22, 1898; Medical Record, February 20, 1904.

[6] Wright and Richardson (Boston Med. and Surg. Jour., 1909, clx, 539) have found structures identical with Spirochæta pallida in five cases of aortitis.

when there is a combined lesion of the mitral and aortic valves, rheumatism and other forms of endocarditis vie in etiological importance with those due to syphilis. In 11 cases of mitral disease alone the Wassermann test was made, and of these, 2 were positive and 9 were negative. In all of these specific infection was either unknown or denied.

Although it was not our purpose to include cases of arteriosclerosis or cases of dilated aorta accompanied by generalized arterial sclerosis, there were two such cases (VII and IX) in our series, one of which gave a positive and the other a negative Wassermann reaction.

In a case seen by one of us in the neurological wards of Mt. Sinai Hospital, a curious light was thrown by the Wassermann test on a condition that seemed unusually puzzling. The patient, a young man, aged thirty years, in good general physical condition, had sustained an apoplectic seizure followed by a left hemiplegia. The hemiplegic attack came on gradually without loss of consciousness, after the fashion of a hemiplegia due to thrombosis and not to embolism. His heart exhibited all the signs of aortic and mitral insufficiency, from which the occurrence of embolism could easily have been explained. In this case the Wassermann reaction was positive, and in view of such positive reaction it seems to us fair to infer that the resulting hemiplegia was not directly due to the cardiac condition, but that there was unquestionably a widespread specific endarteritis, which, as in so many other cases, was responsible for a hemiplegia due to thrombosis.

The value of this test, from the point of view of therapeutics, was well demonstrated by the following cases: A young man, aged thirty-seven years, was admitted to the City Hospital with symptoms which suggested aneurysm, but the preponderance of evidence was finally in favor of incompetency of the aortic valves. The diastolic murmur over the entire aortic area, which was propagated down the sternum, the Flint murmur, the forcible apex beat, and the hypertrophy, despite the apparent difference in the radial pulses, indicated aortic regurgitation. The patient made marked improvement under rest and mercurial medication, which was pushed to the extreme as a result of a positive Wassermann finding.

A positive finding helped to confirm the diagnosis of aneurysm in the following case: A negro, aged fifty-three years, who had had a chancre at twenty, complained of dyspnœa one year previous to his admission to the City Hospital. Six months later he began to cough and to have trouble in swallowing, and about this time he complained also of pain over the sternum. Physical examination revealed a tracheal tug, no pulsation of the neck, a soft, blowing, systolic murmur over the entire upper part of the sternum, profound dulness over the transverse arch of the aorta, and a distinct difference in the volume of the radial pulses. He had likewise a chronic interstitial nephritis. The aneurysm ruptured into the left pleural cavity.

It was large and sacculated, about 15 cm. in diameter, and has its opening into the aorta in the lower part of the transverse arch; anteriorly it pressed against the sternum. The left lung was adherent to the aneurysmal sac. There was a rupture of the aneurysm about the centre of the anterior wall along the line of adhesion of the lung. The left recurrent laryngeal nerve was involved in the adhesions.

In the accompanying table the main facts are stated in condensed fashion upon which our conclusions are based. These are: (1) From a study of 36 cases of cardiac and vascular disease the importance of syphilis as a causative factor is established in a very large percentage of all the cases. (2) The highest percentage was obtained in cases of aneurysm, in which a positive Wassermann reaction was obtained in all of five cases. In the cases of aortic disease 10 out of 13 cases gave a strongly positive reaction; 2 gave a weak positive reaction. (3) In marked contrast to this are the cases of diffuse chronic endocarditis affecting the mitral valve, in which only 1 of the 7 cases gave a positive reaction. The inference is justified that rheumatic and other infectious agencies are a much more potent etiological factor in diffuse chronic endocarditis than is syphilis. Taking all these facts into consideration, there can be little doubt that when we have pronounced symptoms of aneurysm or of aortic disease it is well to suspect syphilis, even though the manifestations may be latent. Citron is no doubt right in believing that syphilis is by far a commoner cause of aortic insufficiency than the history and the clinical findings would seem to suggest. Even in those cases in which articular rheumatism and other infectious agents may have played some sort of role, and in which metallic poison or abuse of alcohol or of nicotine be admitted, if a Wassermann reaction gives positive results, antisyphilitic treatment should be instituted, whatever else may have been discovered regarding the antecedent history of the patient. No doubt articular rheumatism and syphilis occur often enough in one and the same individual, and if the course of antisyphilitic treatment has been decided upon, we may at least ask that it be properly administered. Without entering upon the many moot points in this therapeutic controversy we are in favor of the routine treatment by hypodermic injection of mercury. We leave the choice of a soluble or insoluble salt to the experiences or the prejudices of the individual practitioner. Our best results have been obtained by the use of deep sublimate injections. It may be argued that little is to be expected from antisyphilitic treatment in an advanced case of aortic insufficiency or of aneurysm. In some of our cases marked improvement in the cardiac and vascular symptoms has followed upon such treatment, but even if the vascular system should not improve upon the mercurial treatment, a positive Wassermann reaction would justify vigorous specific treatment for the purpose of preventing serious syphilitic involvement of other organs and systems of the body.

THE VARIOUS TYPES OF PLAGUE AND THEIR CLINICAL MANIFESTATIONS.[1]

By Khan Bahadur N. H. Choksy, M.D.,
SPECIAL ASSISTANT HEALTH OFFICER TO THE BOMBAY MUNICIPALITY, IN CHARGE OF THE ARTHUR ROAD INFECTIOUS DISEASE HOSPITAL AND THE MARATHA PLAGUE HOSPITAL, BOMBAY, INDIA.

The invasion of the human organism by Bacillus pestis manifests itself in certain well-defined and clinically recognizable forms. Their development is determined solely by the path of entrance of the virus into the system: (*a*) If the infection takes place through the skin, by the bite of a rat-flea, or any other agency, and is conveyed into the lymph glands by the lymph stream, the *bubonic* type is the result; (*b*) if, under identical conditions, the infection becomes localized in the skin and subcutaneous cellular tissue, with or without secondary involvement of the lymph glands, the *cellulocutaneous* type ensues; (*c*) if, again under the same circumstances, the blood stream becomes directly infected, the *septicemic* type develops; and (*d*) if the lung-tissue becomes primarily infected, through inhalation or other causes via the air passages, the *pneumonic* type ensues.

Four clinical types are, thus, capable of differentiation at the bedside, each having special characteristics of its own, and each with an important bearing upon the prognosis. The almost classical and synonymous association of the word buboes—*emerods* in Biblical language—with plague, absorbed the whole attention of the observers to the exclusion of the other types, when the disease first broke out at Bombay. Clinical observation, however, soon revealed the presence, as Childe[2] was able to demonstrate, of a few cases of the pneumonic type in 1897. Subsequently the septicemic type was encountered and described by several observers, including myself; and finally, after careful study of a number of cases, extending over three epidemics, I was enabled to verify and describe the cellulocutaneous type in 1900.[3]

All these types do not prevail to the same extent. Hospital experience at the Arthur Road and Maratha Hospitals at Bombay,[4] throughout twelve epidemics comprising over 13,600 cases, shows that the *bubonic* type contributes 92.8 per cent. of all cases; the *cellulocutaneous* type, 3.7 per cent.; the *septicemic* type, 2.4 per

[1] Read by title at the sixth annual meeting of the American Society of Tropical Medicine, Washington, D. C., April 10, 1909.

[2] Transactions of the Medical and Physical Society of Bombay, 1897.

[3] Some Observations on Plague and its Treatment with Lustig's Serum, Transactions of the Medical and Physical Society of Bombay, 1900.

[4] N. H. Choksy. An address on the General Pathology and Serum Treatment of Plague, 1908.

cent.; the *pneumonic* type[5] 1.0 per cent.; and *pestis ambulans*, 0.1 per cent. These ratios, however, are not constant even for all of India; and in other parts of the world many variations have been recorded. At Hongkong, for instance, Koch[6] has reported the following incidence: The bubonic type, 63.6 per cent.; the septicemic type, 31.4 per cent.; and the pneumonic type, 5 per cent., in 510 patients observed during 1904.

I. The Bubonic Type. Within three days after infection and usually without any prodromes,[7] the patient becomes suddenly ill, sometimes in the midst of his work, has a rigor, feels giddy, and may even fall in the act of walking. The temperature begins to rise almost immediately and simultaneously with it, pain and tenderness in the infected glands are complained of. Such glands may be situated in different parts of the body, the order of frequency being the femoral, inguinal, and iliac glands, separately but more often in continuation, the axillary, and the brachial chain with the epitrochlear, the cervical, parotid, and submaxillary glands, and but rarely those in other positions, such as the femoral chain, the popliteal, in the calf, at the ankle, at the bend of the elbow, pre-auricular, or even occipital. The eyes become suffused, the mind somewhat dull, the speech faltering, and the expression either apathetic or anxious and frightened The patient is generally averse to acknowledge that he is at all ill, and often refuses to take to his bed. Even if convinced that he is afflicted with plague—for there exist but few who do not realize it—he persists in ascribing his symptoms to a chill or exposure, and the swelling and pain in the bubo to a sudden strain and more often to the initial fall. On the other hand, it often happens that the patient not only apparently deludes himself, but succeeds in deceiving those around him, by denying the presence of pain or tenderness in the bubo, and if the medical attendant is not confident or resolute in his diagnosis, he shares the same fate, to the ultimate ruin of the patient. As the temperature rises, the pulse becomes quickened, usually out of all proportion to the normal ratio, is found to be of low tension and easily compressible, even within a few hours. There may be nausea or vomiting, mostly of bile, and by the evening the temperature becomes elevated to 104° to 105°; there is restlessness and insomnia, if not actual delirium. Pain and swelling in the bubo are more noticeable, and periglandular œdema may appear. The patient thus presents within a few hours all the cardinal symptoms of plague.

[5] Major G. Lamb, I.M.S. The Etiology and Epidemiology of Plague: A Summary of the Work of the Plague Commission, 1908. The Plague Research Commission states that the proportion is about 2.5 per cent., and that is probably correct, inasmuch as many cases go unrecognised and others succumb at home.

[6] Colonial Medical Report for Hong Kong for the Year 1904, Journal of Tropical Medicine, August 1, 1905.

[7] No local lesion is noticeable at the seat of infection except among 8 to 10 per cent. of cases.

The following morning a slight remission in the temperature may or may not be observed, but without any amelioration; all the symptoms, general and local, become more intensified; the tongue is now dry and presents the characteristic appearance of wash leather, but with a red tip and margins; the weakness of the circulation is more pronounced, and the extremities are cold. The patient does not like to be disturbed out of the position he may have assumed, resents all or any interference, is obstinate, and refuses nourishment and medicines; there is extreme irritability, coupled with greater dulness of the mental faculties; the speech is thicker, the syllables being drawn out, or there may be aphasia; delirium may exist; and the temperature rises to the same or even a higher range than the first day. After a restless night and the lapse of forty-eight hours, there appears a distinct and perceptible remission in the temperature, varying from 1° to 4° or more, with or without apparent amelioration. If the former, it is extremely deceptive and of short duration, inasmuch as within a few hours there is a complete change for the worse in every respect. The usual course however, is for the remission to be unaccompanied by any temporary improvement. As all the symptoms become more and more aggravated, the buboes are larger and more prominent, the local œdema greatly increased, the pulse feebler. By evening the temperature again becomes elevated to the same or even a higher level than on the previous days. With these symptoms the patient may be said to enter the most critical phase of the disease, inasmuch as the following two days decide his fate—the average duration of fatal cases being but five and one-half days. Here we are practically at the parting of the ways the future depending upon two factors: (1) It depends upon the extent of the cardiovascular paresis, as also upon the acute infective degeneration of the myocardium brought about by the toxemia. These lead to sudden cardiac syncope or gradual enfeeblement of the circulation, with eventual heart failure, preceded by a slowly progressive œdema of the lungs, owing to the vicious circle set up between the circulatory and the respiratory apparatus. Should this occur, death usually takes place between the third and fifth days of illness. Fully 82 per cent. of all deaths among these cases occur within this period, and 18 per cent. thereafter. The average rate of recovery among them is about 55 per cent. (2) It depends upon the presence of septicemia, for it is about this period, that is, the third day—though in a few cases even earlier—that this primary dominant factor in plague shows itself. Instead of the infection remaining strictly localized within the lymphatic system, it becomes generalized through infection of the blood stream, owing to numerous direct communications that naturally exist between the lymph channels, on the one hand, and arteries and veins on the other, in the axilla, the side of the thorax, in the groin and other situations where buboes mostly predominate. In the case of deep abdominal

buboes the veins become adherent to them, and thus direct infection of the blood is brought about. Once Bacillus pestis gains entrance into the circulation, it multiplies enormously, and rapidly becomes distributed throughout the internal organs, notably in the spleen and the liver. Masses of bacilli cause embolic infarcts in the organs, besides inducing terminal pneumonia. And as disintegration goes on simultaneously with multiplication, the liberated endotoxin simply floods the tissues, produces necrotic degeneration of the organs, and sets up hemorrhages from almost all hollow and solid viscera; profound changes in the finer elements of the nervous system occur from the toxin combining with the tissue cells, disorganizing their functions and laying in train the seeds of future mischief, the effects of which time and patience alone can eradicate.

The septicemia is generally of a progressive type, being most intense just prior to death; the number of organisms present in the blood may vary from 10 to 1,000,000 per cubic centimeter, and the growth of colonies on sloped agar from 0.1 c.c. of the blood may be few, fairly numerous, numerous, or very numerous, as classified by the Plague Research Commission.[8]

The development of septicemia can only be positively confirmed by bacteriological examination of the blood by culture, as the microscope fails to give any positive indication except in about 17 per cent. of such cases. The clinical signs, however, in about 72 per cent. of these cases raise a strong presumption of its presence; these consist in a quick, thready, compressible or almost imperceptible pulse, accompanied by intense nervous prostration, jaundice, and rapid wasting of the muscular and adipose tissues of the face, the features becoming pinched and hollowed out, even in the course of a single night, together with hemorrhages from the stomach, kidneys, or intestines. *Per contra*, the condition of the patient in about 28 per cent. of such cases, even in spite of a profound septicemia, is apparently so favourable that the physician is often deceived; the prognosis suddenly and, indeed, without any warning becomes falsified within a few hours, as death takes place by rapid cardiac failure. About 85.5 per cent. of all deaths among septicemic cases occur within six to seven days of illness, and 14.5 per cent. thereafter. The average recovery rate among them varies from 3 to 4 per cent. only, as compared with 55 per cent. among the non-septicemic.

If the ultimate fate of the patient is to be decided by the first factor—cardiac failure through toxemia—his general condition becomes gradually worse after the evening of the third day, the temperature oscillates until death between 102° to 104°, the delirium becomes fierce or maniacal, requiring physical restraint; he refuses

[8] Journal of Hygiene, Extra Nos. 1 and 4, being Reports on Plague Investigations in India, September, 1906, and May, 1908.

medicines and nourishment, and each act of struggle or restlessness adds to the efforts of the greatly embarrassed heart, until it eventually ceases to beat, the patient sometimes expiring in the course of or immediately after a violent attempt at exertion, engendered presumably through deficient oxygenation or air-hunger. On the other hand, if a septicemia is to be the determining factor, the struggle between its steady, onward progress and the defensive processes of the system is no less arduous or prolonged. The clinical features above described supervene, the temperature, however, affording no clue; terminal pneumonia, internal and external hemorrhages, a semicomatose condition or actual coma, end the scene within the first week. Whenever a septicemia is limited in extent or is controlled by the action of the antipest serum, and the life of the patient thus prolonged, he drifts into marasmus, which I have described fully in a paper read at the Bombay Medical Congress of 1909.[9]

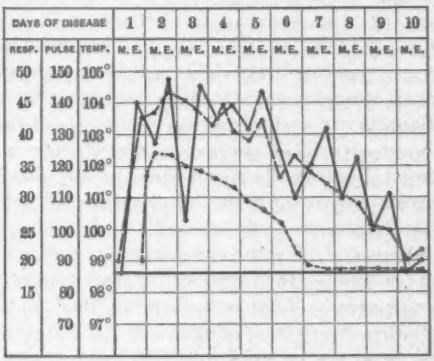

FIG. 1.—Chart of a normal case of plague of the bubonic type. (Solid line = temperature; dash line = pulse; dotted line = respiration. Same device in the other charts.)

If the patient is to recover, the further progress of the case is demonstrated by the accompanying chart (Fig. 1). After the lapse of forty-eight to sixty hours or longer since the evening of the third day, that is, by the sixth or seventh day, a gradual but perceptible change for the better becomes evident. The temperature slowly declines, there is amelioration in the general condition, the pulse improves in volume and tension, and the bubo or buboes become more circumscribed and prominent from commencing necrosis and suppuration. The pyrexia terminates by lysis, by short elevations and remissions, until it reaches normal on the morning of the ninth

[9] N. H. Choksy. On the Clinical Significance of Septicemia in Human Plague, Bombay Medical Congress, 1909.

or tenth day, the tongue gradually clears, the appetite returns, the patient's appearance is brighter, and a very hopeful sign—he commences to grumble about something or other, or everything imaginable. Should the buboes suppurate, incision is required. The curve of temperature in a normal and uncomplicated case is thus limited to about ten days; occasionally it is shorter, but never less than eight days. It is usually divisible into three curves, the first terminating on the morning of the third day, the second on that of the sixth or seventh, and the third on or about the tenth day. This indicates that the disease is self-limited and bound to run a definite course, and that no abortive treatment can possibly deflect or modify its course except the early and liberal use of the antipest serum. Variations in the above curve are numerous: there may be but two only, or they may merge into each other; and, besides, complications, deep-seated buboes or their extension, or a succession of buboes in different positions, each ushered in by a well-marked elevation—all these render the curve unrecognizable except to an expert.

II. The Cellulocutaneous Type. The development of the cellulocutaneous type is dependent upon the peculiar property of Bacillus pestis whereby its protoplasm or endotoxin is capable of setting up inflammatory and retrogressive changes of tissue elements, leading to progressive local necrosis. Klein[10] says, in reference to other organisms (but equally applicable to the bacillus plague), that the necrosis following typical symptoms of inflammation is the result of the local action of the bacilli, and so long as they are in sufficient numbers and of sufficient virulence, and so long as their multiplication proceeds, the necrosis of the tissues spreads into larger and larger areas. That is well exemplified in the case of the large necrosis often observed in plague.

Definite lesions at the point of infection exist in about 8 to 10 per cent. of cases, consisting in the development of phlyctenules, pustules, bullæ, and umbilicated bullæ. It is from the latter that this type originates. If the bulla is cut open or bursts of itself and the central core is removed, its point of attachment to the base appears as a small dark spot. It gradually increases in size until the whole of its base is encroached upon, and obliterated by a dark eschar. This continues to spread at the circumference from day to day until a period is reached when the medium suitable for the further multiplication of Bacillus pestis becoming exhausted, a line of demarcation appears. The eschar assumes a dark greenish hue, feels cold to the touch, is almost hard and leathery, and depressed in the centre, as if firmly bound down to the tissues underneath. Its spreading margin, somewhat higher, is conterminous with the surrounding skin, which becomes converted into a hard, angry, in-

[10] Brit. Med. Jour., August 4, 1900.

flamed areola studded with minute vesicles; and often small, secondary necrosis is noticeable at some distance from the periphery through infection from the parent necrosis when it hapens to be extensive. Multiple umbilicated bullæ are also occasionally met with on different parts of the body surface, each giving rise to a small necrosis. If a little fluid be examined from the margin, it invariably shows a pure culture of Bacillus pestis. The destructive process, if limited, becomes a comparatively benign form of plague, to which I have applied the term "Cellulocutaneous Plague."[11] The buboes, if present—they are not invariably so—are secondary; and although, owing to the slowness of the process, the course of the disease is prolonged from two to three weeks instead of the normal period of eight to ten days, the recovery rate is higher. It is probable that recovery is determined, as Pescarolo and Quadrone[12] say in relation to Eberth's bacillus in typhoid fever, by the behavior of Bacillus pestis in the tissues in relation to the processes of infection and immunization, which differs, as we have already seen, from what it is when confined to the circulation; and in its conflict with the cellular elements of the tissues, immunizing bodies are produced which bring the infective process to a rapid termination. Should the necrosis become extensive, as in some cases it does, involving as much as sixty to ninety square inches of the body surface, the infection becomes generalized and the patient succumbs through septicemia.[13] Once the line of demarcation has formed, it is not difficult to remove the entire slough en masse, leaving behind a saucer-shaped depression in the subcutaneous tissue (often exposing the deep fascia and muscles) of gradually increasing depth from the periphery to the centre, filled with shreds of necrosed tissue, pus, and blood; it gradually assumes a healthy aspect under appropriate treatment. Such necroses have been observed on the scalp, neck, face, back, chest, arm and forearm, the abdominal wall, lumbar and gluteal regions, over the mammary gland, the vulva, and on the scrotum, the thigh, leg, and foot; in fact, wherever such umbilicated blisters might be situated The destruction of the soft tissues is often enormous, and large cavernous cavities exposing the bones of the face and head, involving exfoliation of the periosteum, and so also the cartilages of the ear, the eyelids, and the nasal bones. The upper and the lower jaws may be exposed when the process is confined to the head, neck, and face; the ribs may become exposed on the side of the thorax, and the testes if the scrotum is involved.

The clinical features are confined mainly to the local manifestation, its progress being marked by a slow and steady advance from

[11] Otherwise called carbuncles, and hitherto assumed to be a complication of plague; also known as pest necrosis.

[12] Zentralb. für inn. Med.; Brit. Med. Jour. (Epitome No. 292), November 14, 1908.

[13] It is also possible for septicemia to occur through the original bulla, before necrosis develops, as in Case No. 129, of 1908, at the Maratha Hospital.

day to day until the line of demarcation forms. The presence of buboes in direct lymphatic communication with the necrosis is dependent upon its extent. If the necrosis is small and less than a dollar in size, the buboes are more pronounced and the clinical phenomena almost identical with those observed in the bubonic type. Should it be larger—four to six inches in diameter—the buboes are of subordinate significance, inasmuch as the invasion being strictly localized, the general disturbance of the system is not so great and the result favorable. When the primary necrosis is at all extensive and oversteps the above limit, there are more chances of a septicemia developing, or, again, the patient may succumb through secondary infection or prostration, even after its excision.[14] The recovery rate is about 36 per cent., as compared with 25 per cent. in the bubonic type, and thus it constitutes the most benign type of plague.

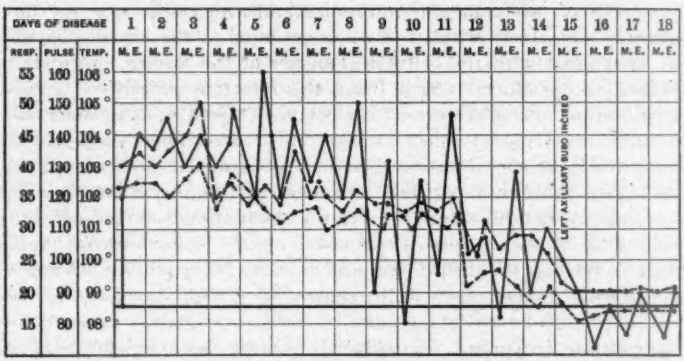

FIG. 2.—Chart of a normal case of plague of the cellulocutaneous type.

The accompanying chart (Fig. 2) illustrates the temperature curve of a case in which two necroses existed under the left costal margin, together with a bubo in the left axilla; the latter suppurated and was incised on the fifteenth day of illness. The course of the affection is seen to be prolonged to a fortnight, and the temperature curve is quite dissimilar to that in the bubonic type.

The accompanying photograghs (Figs. 3 to 8) demonstrate the varying extent of the necrosis in different cases.

III. THE SEPTICEMIC TYPE. The septicemic type owes its origin to primary infection of the blood, Bacillus pestis gaining direct entrance into the circulation.[16] The course of the affection is vari-

[14] N. H. Choksy. The Treatment of Plague with Prof. Lustig's Serum, Bombay, 1903.

[16] Malignant infection, with tiny deep-seated buboes and early septicemia, is liable to be mistaken for septicemic plague, the true nature of such cases being revealed only at the autopsy.

able, extending from five to ten days. As in secondary septicemia in the bubonic type, a certain proportion of cases do not exhibit

FIG. 3.—A small necrosis on the back in the lumbar region with secondary buboes in Scarpa's triangle; recovery.

FIG. 4.—A large necrosis involving the forehead and side of the face over the temporal, zygomatic, malar, and nasal regions, with destruction of the upper and lower eyelids; recovery.

any clinical signs of grave systemic infection; so also there exist similar cases in the primary infection, in which, beyond a persistent high temperature with short morning remissions and evening exacerbations and a weak and frequent pulse, there is total absence of all grave symptoms: no jaundice, no wasting, no prostration, no delirium

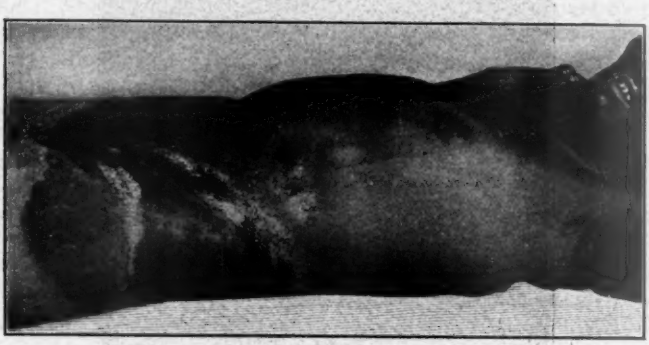

FIG. 5

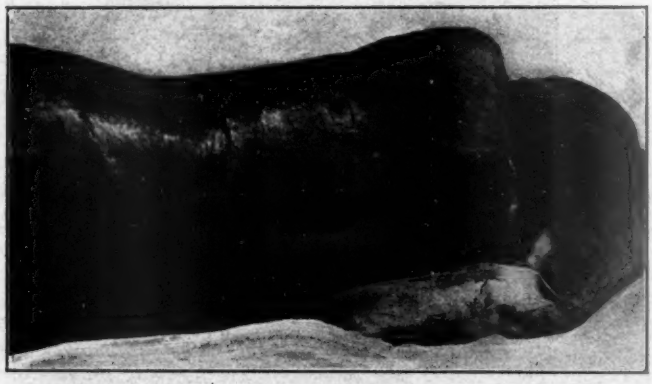

FIG. 6

FIGS. 5 and 6.—Front and back views of an extensive necrosis, extending from the fold of the groin to the iliac crest, over the hip, and to the lumbar region, with small secondary necroses; fatal.

the mental faculties perfectly clear, and to all intents and purposes nothing apparently serious to bespeak a fatal termination within three to six days. And yet, such is the way in which they invariably terminate. The only possible means of diagnosis is by culture of the blood, which is not often undertaken until too late, and by the time it becomes confirmed the patient has succumbed through cardiac failure.

The accompanying chart (Fig. 9) illustrates the course of such a case with all the above characteristics.

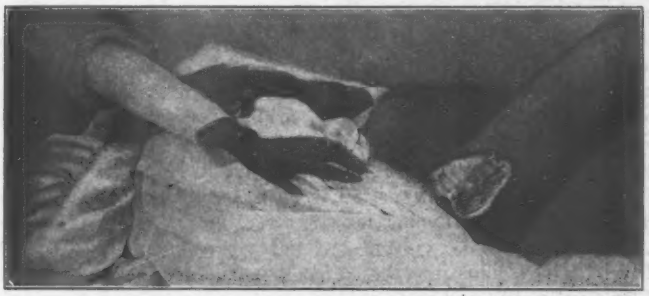

FIG. 7.—Secondary necrosis from the bubo infecting the subcutaneous cellular tissue in Scarpa's triangle; recovery.[15]

FIG. 8.—Wounds from two necroses, one on the scalp and the other on the side of the neck, in the process of cicatrization.

[15] Secondary necrosis from infection of the skin and subcutaneous cellular tissue by the bubo is occasionally met with, when the latter rapidly enlarges, comes up to the surface, and forms adhesions. It spreads similarly as the primary, and when the eschar is removed, the bubo is found to be firmly attached to its under surface.

By far the more common, however, is the type in which the symptoms are well pronounced at the very outset, the temperature usually following until the fourth day the ordinary course, as in the bubonic type, but variable thereafter. An extremely weak and thready pulse, intense and grave jaundice, profound nervous prostration, the limbs heavy and almost leaden, stupor or coma, the tongue brown, hemorrhages from the stomach, kidneys, or intestines, or subconjunctival, coldness of the extremities, and a few hours before death the appearance of one or more buboes in different parts of the body—such is the clinical picture exhibited. The only affection for which such cases are likely to be mistaken is grave spirillar infection in relapsing fever, but the absence of spirilla in the blood and the culture test confirmed the diagnosis. The following charts illustrate the course of such cases: Case No. 1721, of 1905 (Fig. 10), indicates the presence of severe melena causing

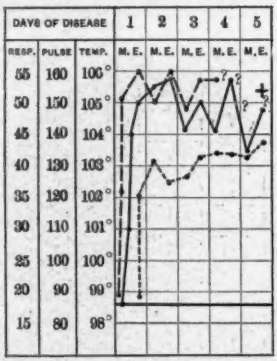

FIG. 9.—Chart of the septicemic type of plague.

collapse with subsequent reaction, and the development of femoral, inguinal, and iliac buboes on the morning of the day the patient succumbed. The other two cases, No. 838, of 1905 (Fig. 11), and No. 65, of 1904 (Fig. 12), show a somewhat more prolonged course, extending between nine to ten days, with the development of buboes on the seventh and ninth and tenth days respectively. In a few septicemia cases, however, the buboes appear on the third day of illness, the affection becomes partially localized within the lymphatic system, and recovery is just possible. But, on the whole, the fatality of these cases is so great that not more than 2 per cent. recover.

IV. The PNEUMONIC TYPE. The most insidious and virulent and at the same time highly infective is the pneumonic type. The infection is usually contracted by inhalation of the fine spray of the infective sputum teeming with the bacilli. It is just possible that

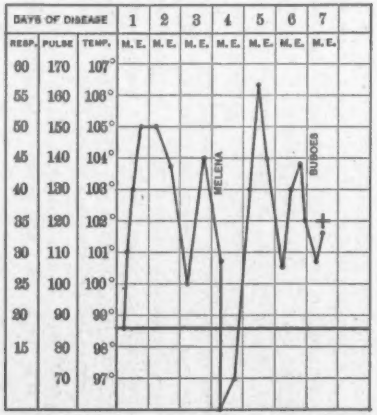

FIG. 10

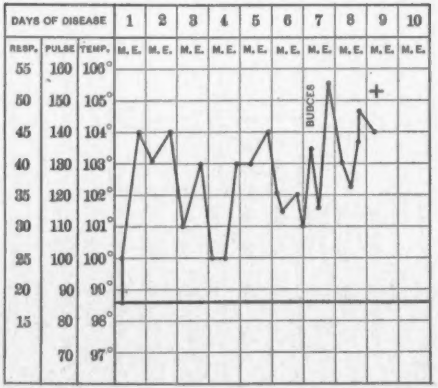

FIG. 11

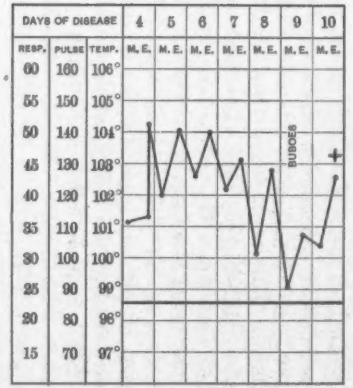

FIG. 12

FIGS. 10, 11, and 12.—Charts of the septicemic type of plague to illustrate the presence of internal hemorrhage and the late development of buboes just before death

it may be conveyed by the infected finger to the pharynx or tonsils, where a focus is formed, whence the lungs become infected. Or, again, the apparent primary pneumonia may be not really so, but a secondary development of malignant infection with deep-seated buboes, not felt during life-time, and early septicemia. The clinical picture of the type is masked in the early stages, and does not exhibit its full development until late. The course varies from three to five days, the termination being invariably fatal (Fig. 13).

Moderate fever, neither the pulse nor the respiratory ratio correspondingly higher; no physical signs, and yet marked prostration and aspect of grave illness; then, within a few hours, some scanty pellets of hemorrhagic sputum, followed by death within twenty-four hours, characterize the disease. The apparent initial mildness rapidly assuming gravity even without the appearance of the char-

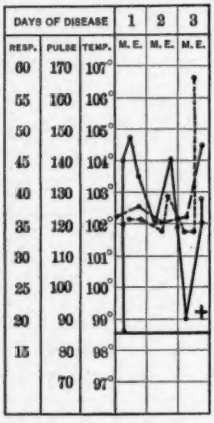

Fig. 13.—Chart of the pneumonic type of plague.

acteristic sputum is a pecular feature of the type. The sputum may be thick, viscid, almost or even purely hemorrhagic or thin and mucoid, tinged bright red; it may be profuse or extremely scanty, and brought up at long intervals. Simple microscopic examination of the sputum is extremely deceptive for purposes of diagnosis, as other organisms simulating the morphological characters of Bacillus pestis are not of infrequent occurrence. Many cases so diagnosticated have eventually proved not to be pneumonic plague. It is, therefore, absolutely necessary to make a culture and inoculate animals with it or with the sputum. If the animal responds to the usual tests, and plague bacilli are recovered from it, then only can the diagnosis be positive.

The rarity of this type and its great infectivity claim special

notice. One single case is often the focus of a whole series of cases. The case of the late Major Manser, I.M.S., and his attending nurses; that of one of the former house surgeons of the Maratha Hospital, with its series of sixteen cases; that of one of the nurses at the Bai Motlabai Hospital, and of the student, both attending upon a case of the pneumonic type, who had miscarried, one and all terminating fatally, are sufficiently appalling. So far as regards Bombay. On the other side of India, Major Green and Dr. Justice[17] have recorded the history of the Baker-gunge epidemic of pneumonic plague, in which one case originating at Calcutta, in the house of Kaviraj Dwarkanath, led to a series of nineteen other cases, all of which proved fatal. Lieut.-Col. Crawford[18] has recorded another similar outbreak, involving twenty persons at Hughli, in January, 1905. In all the above instances the infective agent was the sputum of the patient, which induced a similar affection among others. Under other circumstances, however, especially if it happens to fall upon an exposed and inflamed mucous surface like the conjunctiva, it gives rise to bubonic plague. The saddest case of the kind that has come under my observation was that of one of the English nurses, at the Arthur Road Hospital. She had a severe catarrh with injected conjunctiva at the time. While bending over a patient to feed him, he happened to cough, and a drop of the infected sputum fell into the eye; three days later she developed plague with preauricular, parotid, and cervical buboes, with infiltration on the side of the infected eye, and eventally succumbed from œdema of the glottis.

No recovery from pneumonic plague in which the diagnosis has been confirmed as above has been hitherto recorded in Bombay. I have seen none in the course of twelve epidemics. I am, however, able to report one instance in which there was double infection of the lungs by Bacillus pestis and Bacillus pyocyaneus. The patient was admitted on the third day of illness—July 1, 1907—with moderate fever, 101.8°; pulse, 101, of fair volume; and respirations, 30; no physical signs and no sputum to indicate the nature of the case, except marked prostration. On the night of the sixth day, however, the temperature rose to 104.4°, the pulse to 130 and respirations to 35, and he developed symptoms of pain, tightness and constriction in the chest, dyspnœa, and cough, with scanty sputum, the naked eye appearance of which was characteristic neither of pneumonic plague nor of croupous pneumonia. It appeared to be somewhat dark and rusty, with a layer of greenish mucus, almost purulent. Physical examination revealed isolated patches of dulness in the middle region on both sides. A culture of the sputum was then made and sent to Dr. Ghadially, the Municipal Analyst, who reported three

[17] Report of the Indian Plague Commission, 1902, p. 91, par. 203.
[18] Indian Med. Gaz., October, 1905.

days later the presence of Bacillus pestis and Bacillus pyocyaneus in the culture, a little scraping from which was inoculated subcutaneously into a white mouse, and it succumbed within forty-eight hours and plague bacilli were recovered from it. There was thus no room for doubt as to the nature of the case. The patient remained in a rather precarious condition for three days, but improved thereafter, the temperature, pulse, and respirations gradually became lower, and when the sputum, which had in the meantime altered its character, was reëxamined on the eleventh idem, the thirteenth day of illness, there were no plague bacilli, but Staphylococcus aureus only; some of the culture from the sputum inoculated into a mouse did not kill it. In the meanwhile infection from the bronchial glands had spread to the deep abdominal and mesenteric glands, and pain, fixation of the abdominal wall, and tympanites developed, the course being subacute, without much rise of temperature after the seventeenth day of illness. Recovery, however, was gradual. In another instance there was double infection from Bacillus pestis and the pneumococcus, and it ended in recovery. Recovery is thus possible in cases of very moderate mixed infection.

V. The Ambulatory Type. The mild type of plague recognized as *Pestis ambulans* is characterized by moderate fever lasting for a few hours to a day or two, one or more small and tender glands, and hardly any constitutional disturbance. The patient may or may not rest; he usually works; and if the buboes get gradually absorbed, there is no other trouble. Occasionally suppuration takes place, whereupon he resorts to the hospital for relief.

Such, in brief, are the various types of plague and their principle clinical features as observed at Bombay. Whether the affection presents essential differences in its types and symptoms in different parts of the world owing to climatic, racial, or other causes, I must leave to others better qualified than myself to say. In so far as Bombay or Western India is concerned, those types prevail, but with a distinct racial incidence and fatality, depending to a great extent upon social conditions and environments. The greatest sufferers with the heaviest mortality rate (76.57 per cent.) are the Hindoos; the Mahomedans come next (68.52 per cent.), closely followed by the native Christians (65.80 per cent.); and lastly the Parsees (50 per cent.)[19] Europeans and Eurasians suffer so little in comparison that their statistics are scarcely worth comparing. The racial incidence of attacks also presents corresponding differences.

[19] These figures relate to the actual case mortality rate recorded among 136,000 patients treated at the Arthur Road and Maratha Plague Hospitals during the twelve epidemics.

LEPROSY IN THE PHILIPPINE ISLANDS AND ITS TREATMENT.[1]

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Notwithstanding the comprehensive title of this paper, it is not my intention to discuss the history of leprosy in the Philippine Islands any farther back than the beginning of American occupation, because that is not essential to the practical questions under consideration, and it has already been done in one of my previous papers.[2]

At the beginning of the period with which this paper deals there were in the Philippines, according to the best record obtainable, between 3500 and 4000 lepers. While it is true that many of the reported cases were, on the application of more accurate diagnostic methods than had at first been employed, found not to be cases of leprosy, there were enough obscure cases overlooked to contraindicate any revision of the figures. There were never any grounds for the estimates ranging from 10,000 to 30,000, which were given circulation in the earlier days of the new regime.

The attempt at partial segregation of the worst cases, which in Spanish times had been begun and carried on by the church authorities as a matter of charity rather than legal proscription, was continued by the Americans, both before and after the establishment of civil government; but a systematic plan which had for its object the reduction of the number of new infections and the ultimate eradication of the disease from the Islands was not begun until 1905, although the island of Culion was selected for this purpose as early as 1901.

This island is well isolated, is roughly 20 by 40 miles in size, and is located about 240 miles from Manila in a southwesterly direction. The lepers are permitted to establish themselves at any place on the island, and if they desire to follow agricultural pursuits, the necessary animals and implements are provided at Government expense. In actual practice, however, it is found that they practically all live in the town of Culion, where everything is furnished for them by the Government. A large modern hospital has been established for those who are bedfast or those who desire to undergo special treatment. The town is located on an elevated site, has a modern water and sewage system, and is practically controlled by regulations and ordinances which the lepers themselves make. If

[1] Read by title at the sixth annual meeting of the American Society of Tropical Medicine, Washington, D. C., April 10, 1909.

[2] Leprosy in the Philippine Islands and the Present Methods of Combating the Disease, Medical Record, June 8, 1907.

the work of collecting lepers could have been rushed through with military rigidity, the problem would have been very much simplified, but it was deemed advisable to precede the collection of the lepers by a campaign of education and thereby secure the coöperation of the public rather than its opposition.

After this preliminary work, the plan adopted and still followed, which the geography of the country so eminently favored, consisted in removing all leprous patients from the well-isolated islands which contained only a few victims, and subsequently recanvassing the territory two or more times for cases which might have escaped, been overlooked, or which subsequently developed. By the method pursued the greatest amount of territory was freed in the shortest possible time. In military phraseology, the outposts were captured first and the lines gradually moved forward to the strongholds.

Experience has shown that when all of the native lepers have been removed from an island, the people of that island may be safely trusted with the duty of keeping foreign lepers from taking refuge there. The better points of human nature are being utilized in the campaign and often times prove valuable weapons.

Commitment to the Colony does not mean permanent separation from friends and relatives, since provision has been made for restricted visiting under proper safeguards from a neighboring island, on which the non-infected are permitted to camp or to live permanently if they desire, in order that they may be permitted to visit their friends and relatives. The law under which the policy of segregation is carried out probably vests more absolute power in the director of health than the laws of other states or countries. Briefly, he has authority to cause to be apprehended every person who is believed to be a leper, and to detain them if the bacillus of the disease can be demonstrated. Furthermore, it is the duty of all officials and others to report to the director of health any case of leprosy that comes to their knowledge. Failure to do so is punishable by fine.

The results of the segregation policy so far have been very encouraging. On February 1, 1909, according to official figures, there were only 2291 lepers in the Philippine Islands, which fact demonstrated that since May, 1905, when effective segregation was begun, the number of deaths has exceeded the number of new cases by 1409. The falling off in the number of new cases is one of the most encouraging evidences of success. It is estimated from the data on hand that under the old system there were about seven hundred new infections annually. During the past year there have not been more than 300 new cases, a difference of about 57 per cent. If these results can be brought about by incomplete segregation, it can readily be seen that the prospect of ultimately reducing the number to insignificant proportions is very encouraging.

In an address before the Philippine Islands Medical Association, more than two years ago, I held that whatever may be the views of

well-informed persons with regard to the communicability of leprosy, and however widely eminent medical men may differ upon this question, the incontrovertible fact remains that every leper who is capable of giving off lepra bacilli is at least one centre of infection, and that it is an utterly hopeless and useless undertaking to attempt to eradicate the disease without removing the source from which it is transmitted; and I asked that prophylactic medicine should not be turned aside by a few sentimentalists from its march to a goal which offered the magnificant hope of the complete eradication of this plague from the face of the earth and the saving of many innocent human beings who are now sacrificed annually to this most loathesome disease through sheer sentimentality. As more and more experience becomes available, these views are constantly strengthening, and it is believed that the cases which cannot be traced to another case are very few.

The most important factor now in connection with the work in the Philippines is early diagnosis. The earliest and most constant symptom observed is a nasal ulcer which is situated on the nasal septum at the junction of the cartilaginous and bony portion. Among 1200 cases taken in regular order at Culion, these ulcers were noted in 799. It is my opinion that if the remaining septums had been examined microscopically, scar tissue would have been found which would be strongly presumptive evidence that ulcers had existed previously. My experience in the examination of more than two thousand Philippine lepers and of those of Hawaii and of the Louisana colony near Bruns, confirms the importance and constancy of this sign, which may often be found long before there are any other objective or conscious subjective symptoms. Writers on leprosy give the incubation stage as from three weeks to twenty-seven years. No reliable data have become available here to prove or disprove this theory. Several Americans, whom it is fair to presume were not exposed to the disease in the United States, were found to have the disease within two years of their arrival in the Philippines.

Its extent and effect in different individuals or in the same patient at different times is very variable. I have seen a number of microscopically positive cases in which the only clinical symptom was a nasal ulcer, perhaps very obscure and innocent looking. Such cases usually come from houses in which advanced cases have existed. For this reason it is customary to have those who have been in contact with bad cases examined for this sign and scrapings submitted to a microscopic examination. The precautions enjoined at the leper institutions under the bureau of health is to protect the nasal mucous membrane as a first consideration, giving second place to, but not under-rating the old-time precautions. The membrane of the nose is easily protected by nasal plugs of sterilized absorbent cotton.

With regard to the types of the disease in the Philippine Islands, a fair estimate may be found from the fact that of 1200 cases studied

in the order of admission, 374 were of the anesthetic type, 157 of the tubercular type, and 650 partaking of the character of both, or mixed cases. It was observed that in a majority of cases the integrity of the eyebrows was disturbed. Among the 1200, the eyebrows had been entirely destroyed in 264 cases, and in 599 cases they were half gone. In the remainder of the cases there was generally some impairment of the appendages sufficient to constitute some degree of expressional deformity.

TREATMENT. As health officers, we are naturally more interested in preventing the disease and in the protection of the public than in the care or relief of the individual, yet no remedy within the realm of reason, whether physiological or empirical, has been neglected. Potassium iodide, mercury, creosote, salicylic acid, chaulmoogra oil, gurgon oil, leprol, nastin "B," experimental sera, and the *x*-rays have all been tried without curative effect, except the *x*-rays, which have proved successful in a few cases, but from our present experience can by no means be regarded as being suitable as a routine treatment. The cases in which they are apparently of value is in the early stage of the tubercular type in young and otherwise healthy subjects. The breaking down by the *x*-rays of one large, leprous granuloma of an individual usually results in marked coincident improvement in the granulomas situated in parts of the body far removed, and to which the *x*-rays have not been applied. One of the cases successfully treated by this method was recently reported.[3]

San Lazaro Hospital at Manila was the first institution in the world to use the *x*-ray treatment for leprosy with any degree of success, but this was probably due to the fact that there were a larger number of cases to choose from and the particular type which yielded to this form of treatment came under observation early. Chaulmoogra oil so far has not proved of value, but owing to the excellent results obtained in Louisana by Dyer with the crude oil, another thorough test of this treatment is being made.

CONCLUSIONS. 1. The experience in the Philipinnes during the past three years demonstrates that segregation has decreased the incidence of leprosy by over 50 per cent.

2. Of all the treatments tried, the *x*-rays is the only one which produced a cure, but as yet it is suitable only for specially selected cases.

[3] Preliminary Notes upon a Case of Leprosy apparently Cured with the *x*-Rays, Medical Record, October 31, 1908.

LUETIC BURSOPATHY OF VERNEUIL.

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Thirty-three years have elapsed since the elder Keyes[1] published in this journal one of the earliest articles on "Syphilis as Affecting the Bursæ." The affection had been first described by Verneuil,[2] who, in 1868, had reported four cases of "hydropisie des gaînes tendineuses des extenseurs des doigts dans la syphilis secondaire," and shortly after the appearance of this article Fournier had published a fairly complete account of the condition, stating that its occurrence was much more frequent than one would suppose from the silence of the literature on the subject. Verneuil's observation had also stimulated opposition; and in the same journal in which his publication appeared, Hérard[3] and Dechambre had written a reply, citing cases of "rheumatism," with the same tendinous lesions, but without the history or signs of syphilis. Still the condition had been soon pretty generally accepted as luetic in origin; and in a few years following Verneuil's second publication, several theses on the subject (Moreau[4] Chouet,[5] Voisin[6]) had appeared, in which a few additional cases were reported, and the new observations were coördinated with those of the early observers. In 1876, however, Keyes was able to collect only fourteen cases, including his own; and he wrote: "The literature of the subject seems wonderfully meagre in facts, so far as I have had access to it. It is to be hoped that further contributions may be forthcoming to make our knowledge more complete." This hope can hardly be said to have been realized. Finger,[7] in 1884, in an extensive article on the general subject of syphilis of the joints, tendons, etc., gave some attention to syphilitic bursitis; Buechler,[8] in 1889, reported four cases, two of them by no means convincing; and reports of occasional cases are found elsewhere. But, on the whole, the subject has received little attention; and it is striking that even in extensive articles on bursal affections—

[1] Syphilis as Affecting the Bursæ, Amer. Jour. Med. Sci., 1876, p. 349.

[2] L'hydropisie des gaînes tendineuses des extenseurs des doigts dans la syphilis secondaire, Gaz. hebd. de méd., 1868, No. 39, p. 609.

[3] Hydropisie des gaînes des tendons extenseurs, Gaz. hebd. de méd., Paris, 1868, No. 42, p. 662.

[4] Les affections syphilitiques tertiaires des bourses séreuses, Paris Thesis, 1873.

[5] De la syphilis dans les bourses séreuses, articulaires, sous-cutanées et tendineuses, Paris Thesis, 1874.

[6] Contribution à l'étude des arthropathies syphilitiques, Paris Thesis, 1875.

[7] Zur Kenntnis der syphilitischen Gelenks, Sehnen, u.s.w., Wien. med. Presse, 1884, xxxiv, 864.

[8] Ueber Bursitis Luetica, Med. Monatschr., N. Y., 1889, 1, 393.

like those of Sonneborn[9] Schuchardt,[10] Schoenborn,[11] Tilger,[12] Unger,[13] and Graffelder[14]—no mention at all is made of luetic bursitis.

Quite as interesting is the silence of earlier writers—even of the acute British syphilographers—on the subject. Richet's classical monograph,[15] the first complete and successful description of the clinical features of syphilitic arthropathies, appeared in 1853; but in this work no separate account was taken of the bursæ. In his first case there was a small fluctuating tumor at the internal tuberosity of the tibia, not connecting with the joint, which was probably due to inflammation of the anserine bursa, though, in the presence of the overshadowing arthritis, it did not attract Richet's attention. Lancereaux,[16] who was the first to attempt to give to Richet's work a pathological basis, made no mention of the bursæ except in Observation II (a case of general syphilis and double arthritis of the knees), in which the "bursa of the rectus," which did not communicate with the joint, was found unaltered. In his text-book he described syphilis of the tendons and aponeuroses, but made no mention of the bursæ. The English surgeons interested in syphilis either overlooked syphilitic bursitis entirely or mentioned it in quite an offhand way, as an incident of the arthritis. Syme,[17] in a chapter on the bursæ mucosæ, said nothing of luetic effusions. Colles,[18] mentioned effusions into bursæ of the large joints in connection with the joint-effusions themselves, but did not treat the affections separately, and thought the bursal effusions due to the injudicious use of mercury. Abernethy[19] was similarly silent, though his Case XIV—in which a painful affection of the upper part of the tibia developed, attended with a collection of fluid under the fascia, the disease having started with indolent buboes—may possibly have been a case in point. Hunter[20] wrote: "We know also that the tendinous parts, when inflamed, give in some cases very considerable pain and that of the heavy kind, while in others they will swell considerably without giving any pain." Swellings of the tendons and fasciæ he treated incidentally with those of bones, but in the chapter, "Of Nodes on Tendons, Ligaments, and Fasciæ," he mentioned "obstinate and disagreeable swellings which neither gave way to medicine or

[9] Ueber Schleimbeutel Erkrankungen, Marburg Thesis, 1894.
[10] Tuberculose u. Syphilis der Sehnenscheiden, Archiv f. path. Anat., 1894, cxxxv, 3, 394.
[11] Ueber Bursitis u. Peribursitis, Würzburg Thesis, 1885.
[12] Zur Pathologie der chronischen Schleimbeutel Erkrankungen, Würzburg Thesis, 1890.
[13] Ueber Bursitis prepatellaris, Halle Thesis, 1887.
[14] Anatomie, Pathologie u. Therapie der Knieschleimbeutel, Würzburg Thesis, 1877.
[15] Mémoire sur les tumeurs blanches, Mém. Acad. de méd., 1853, xvii.
[16] Union méd., 1873, pp. 153 and 182; Traité de syphilis, 1866, p. 264.
[17] The Principles of Surgery, 1832.
[18] Practical Observations on the Venereal Disease and on the Use of Mercury, 1837.
[19] Surgical Observations on Diseases Resembling Syphilis, and on Diseases of the Urethra, 1822.
[20] Of the Lues Venerea.

time." Velpeau, in his *Lectures on Clinical Surgery*, recognized an extracapsular arthropathy for which he recommended inunctions with potassium iodide or even mercury; and for "white swelling" he used O'Brien's mercurial treatment, giving very large doses of calomel with opium. These were his results: "In arthropathies with hydrarthroma, without changes of the hard parts, and without spongy degeneration of the capsule, the disease improved rapidly and the exudate was entirely absorbed in from eight to fourteen days." It is not at all impossible that he was unknowingly treating lues.

The meagre state of the literature of syphilitic bursitis, both before and since Verneuil's time, gives to the recent occurrence of a case in the service of Dr. Halsted at the Johns Hopkins Hospital a peculiar interest. This is the only instance of the condition that, so far as I can find, has been observed in this hospital, and no similar case has since occurred in the skin and genito-urinary dispensaries, though we have been on the lookout for the condition.

The patient was a negress, aged twenty-nine years. She had been married four and one-half years, and had had no pregnancies. Her family and personal history were negative for tuberculosis. Her occupation was housework. She denied venereal infection. She had worked on her knees a good deal as a scrub-woman. About two and one-half years before admission she noticed a lump below the left patella, which caused her a good deal of discomfort when on her knees. About one and a half years later a similar swelling appeared on the right knee, but this was never painful. Two years before admission painless nodules appeared on the back of each olecranon, and about sixteen months later she first noticed a circinate eruption on the right forearm, soon followed by a similar lesion on the left arm. She presented, on admission, subcutaneous gummas of the forearms and lower legs, roughened tibiæ, the pigmented scars of old luetic lesions on the legs, and a circinate eruption of the forearms and thighs. The prepatellar bursa on each side was enlarged and contained fluid not under tension. The swellings measured about 4 x 4 cm., and their summits were elevated about 2 cm. above the skin surface. There was no sign of skin involvement, no tenderness, and the joints were quite normal. On the posterior surface of the right olecranon, about 1 cm. from its tip, there was a hard, not tender, movable nodule about 2.5 cm. in diameter, and a similar one 7 cm. below the tip of the olecranon on the left side. In the presence of the signs of tertiary syphilis, and of the symmetrical and indolent character of the bursal involvement, a diagnosis of syphilitic bursitis was made. The patient was put on bichloride of mercury ($\frac{1}{16}$ grain three times a day) and increasing doses of potassium iodide. In about one week the eruption had partly disappeared and the prepatellar bursæ were smaller. The patient left the hospital against advice; but continued her treat-

ment for about three weeks. She was next seen sixteen months later. The skin was quite free from the eruption, the subcutaneous gummas were gone, there were no signs of the retroölecranal swellings, and the prepatellar effusions had entirely disappeared. On the left side slight thickening of the tissues superficial to the patellar tendon remained, but there was absolutely no fluid present. The patient is still under observation and specific treatment is being continued. At present (nearly nineteen months after admission to the hospital) there is no sign of recurrence. The patient could not say when the swelling of the prepatellar bursæ entirely disappeared, but she stated that it was not later than four weeks after she left the hospital.

The clinical features of this case were similar to those in the original description given by Verneuil. Of his four cases (the first of which was seen in 1863), only one was reported in detail, but the others were said to be quite like it. In all of his patients the bursa involved was the one about the extensor tendons on the dorsal surface of the hand, distal to the annular ligament; and he remarked that the condition had, until then, been observed only in the hand, though "it must be sought for elsewhere." All his patients were women and all presented signs of secondary syphilis. In three of his cases the condition was symmetrical, in two there was a coincident luetic arthralgia. The effusion appeared suddenly, and formed a circumscribed tumor with no skin involvement. Tenderness was very slight and disability practically absent; the cure was rapid and easy. Not only the clinical course, but the response to treatment proved the luetic nature of the disease.

Keyes added to what Verneuil[21] had written, the clinical description of the bursitis of tertiary syphilis, and was able to gather twelve fairly well reported cases from the literature. His search was not perfectly thorough (the case of Labarthé,[22] for instance, he overlooked), and a few scattered cases have been reported since; so that I have collected all the cases published[23] and have tabulated their features.

Before discussing the clinical picture of the condition it is interesting to inquire into the structure and development of the bursæ mucosæ, particularly as light is thus thrown on their relation to the joints and incidentally on the pathology of bursitis. For the condition of syphilitic bursitis is, it is to be remembered, an affection of the bursæ mucosæ, *lying in the tela*, for the most part unconnected with the joints and, as we shall subsequently see, constituting, so

[21] Lésions syphilitiques tertiares des bourses séreuses sous-cutanées et tendineuses, Gaz. hebd. de méd., Paris, January 10, 1873; Gommes peri-articulaires, Jour. de méd. et de chir. prat., 1876, p. 398.

[22] Gomme syphilitique de la bourse séreuse, etc., France, méd., Paris, 1873, xx, p. 804.

[23] Two references—one to an article by Ingold and the other to a Munich thesis by Specht—I have been unable to find; it is possible that original cases are there reported, though there is no reference to them in the subsequent literature.

far as syphilis is concerned, organs quite independent of them. The analogy between the joints and the subcutaneous bursæ has probably been too readily assumed; and the pathological conditions which affect the one have been taken for granted for the other in a way which the facts do not warrant.

Anatomical Considerations. The bursæ were rather late to be discovered. The work of Monro,[24] published in 1788, was one of the early complete descriptions; but Albinus, in 1734, described sixteen pairs of shut sacs interposed between the tendons and bones, to which he gave the name of bursæ mucosæ.[25] Winslow had previously observed the bursal sheaths about the tendons at the wrist and the ankle; but the subject had been pretty generally overlooked by anatomists up to this time.

Once the bursæ were observed, an attempt was made to account for them; and in the absence of careful microscopic and embryological studies the attempts were not successful. Monro, on the basis of numerous gross anatomical and pathological analogies, regarded the bursæ and the joints as identical in structure; but most observers inclined to the view of Virchow that "the bursæ are in no sense true serous sacs, . . . but are rather places where the connective tissue, originally present *in continuo*, forms spaces by a process of atrophy and where these spaces come, in time, to be independent cavities."

An extensive investigation of the embryology of the bursæ mucosæ has been made by Retterer.[26] This observer recognizes five stages in the development of connective tissue: (1) In the earliest stage the primordial connective tissue consists of homogeneous protoplasm containing nuclei but no cellular units. (2) The first change is an appearance of fibrillæ in the ground substance. (3) Then begins an active mitosis; cells are formed and processes are sent out, constituting a network which encloses "hyaloplasm" in its meshes (mailles pleines). (4) The fibrillæ then become finer and smaller in number, the cells disappear, the hyaloplasm liquifies, and spaces result (mailles vides). (5) Finally, atrophy of the fibrillæ occurs and cavities are thus formed. The "serous" spaces are, therefore, *not* intercellular lymphatic spaces; they arise by evolution and solution from *all* the connective tissue elements. The connective tissue is, in the early state of rest, homogeneous; in the succeeding states the fibrillæ give it first a fibrillary, then an alveolar, and finally a reticulated structure.

Originally, the tendons are covered with connective tissue arranged in parallel layers, the homogeneous protoplasm lying about

[24] A Description of all the Bursæ Mucosæ of the Human Body, Edinburgh, 1788.

[25] This name—though manifestly inaccurate—has persisted, and is here used on account of its general acceptance.

[26] Sur la developpement morphologique et histologique des bourses muqueuses et des cavités péritendineuses, Jour. de l'anat. et physiol., 1896, xxxii, 256.

the parallel oval nuclei. This undergoes solution and intraprotoplasmic (*not* intercellular) spaces are formed. Next the tendon, the connective tissue sheath is continuous with the intratendinous connective tissue. The superficial lining "endothelial" cells of the bursæ are, therefore, of connective tissue origin; the cavity, which is formed by solution of the connective tissue, continues to be lined by persisting nuclei with their perinuclear protoplasmic zones; these "cells" continue to be united by fibrillary, protoplasmic prolongations, and so simulate a membrane.

The bursæ mucosæ are present in fœtal life and at a period when the muscles are still incapable of causing, at least marked, motion; for this reason they must not be regarded as of mechanical origin, though it is not improbable that motion plays some part in their later development. The time at which they appear varies with their site; in general, the deeper bursæ appear first. At the sixth month of fœtal life the subcutaneous bursæ are not yet present; but the skin at the site of the future bursa consists, at this stage, of a superficial firm layer containing hair follicles, sweat-glands, etc., and a deep layer of looser structure in which the bursæ develop. The retroölecranal subcutaneous bursa appears about the second month of life, but the bursæ of the lower extremity appear earlier; the sub-Achilles bursa, for example, in about the fourth or fifth fœtal month. Of the subcutaneous bursæ, those of the knee (and the subfascial prepatellar bursa is the earliest of these) appear first, the bursa of the calcaneus next, and the olecranal bursæ last (Dömény).[27]

The origin of the accidental or professional bursæ has always been an interesting question. In a vague sort of way they have been thought of as the result of repeated movement or insult. But the immediate result of such traumatism is, according to Retterer, *not* cavity formation, but cellular proliferation. The cavity is formed later by liquefaction, that is, cellular activity. A hygroma is therefore originally a nodule of connective tissue, and the cavity, in both hereditary and accidental bursæ, results from protoplasmic activity.

The chief point of dispute as regards the structure of the bursæ mucosæ concerns the existence of an epithelial lining; and it seems quite probable that the contradictory observations of various authors have resulted from the fact that the bursæ mucosæ vary greatly in their make-up with age, sex, habits, profession, previous diseases, etc. Their walls, at any rate, consist largely of connective tissue, in which three layers may be recognized (Delord).[28] The external layer, which is made up of interlaced fibers, is not sharply limited externally, is continuous with the surrounding connective tissue, and contains elastic fibers and fat cells. The middle layer is denser than

[27] Entwickelung u. Bau der Bursæ Mucosæ, Archiv f. Anat. u. Entwickgesch., 1897, p. 295.
[28] De la bourse séreuse rétro-olécrânienne sous-cutanée et de ses maladies. Paris Thesis, 1893.

the external, and the internal layer is densest of all, elastic fibers and fat being here absent. An apparent endothelial lining is certainly sometimes present, but it is by no means constantly seen; and the preponderance of evidence seems to favor the view that the nuclei present belong to the original connective tissue fibers. Within the bursal cavity connective tissue processes are often found normally, and this is to be regarded as a sign of their origin through lacunization, rather than by an orderly development.

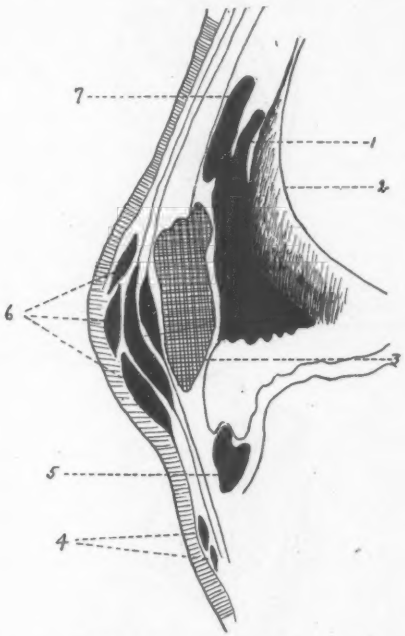

FIG. 1.—The bursæ mucosæ about the anterior aspect of the knee. (After Poirier.) 1, synovial prolongation; 2, femur; 3, patella; 4, pretibial bursa; 5, deep infrapatellar bursa; 6, superficial prepatellar bursæ (between these and the patella lie the median and deep prepatellar bursæ); 7, subtricipital bursa (in the diagram shown connecting with the joint cavity).

The chief bursæ of interest in connection with syphilitic bursopathies are those at the elbow, the wrist, the knee, and the ankle. The region of the knee is richly supplied with these structures, and their sites are illustrated in the accompanying sketches (Figs. 1, 2, and 3). Those of particular interest in connection with syphilis deserve special menton.

The Prepatellar Bursæ. Of these, there are three—the superficial or subcutaneous, the median or subaponeurotic, and the deep

or subfascial. Often only one of these is present, and when there is more than one they usually intercommunicate. The subcutaneous prepatellar bursæ (Fig. 1, *6*), which were found by Bize in 88 per cent. of thirty-five cases, lie between the superficial fascia and the expansion of the fascia lata. Frequently they are multiple;

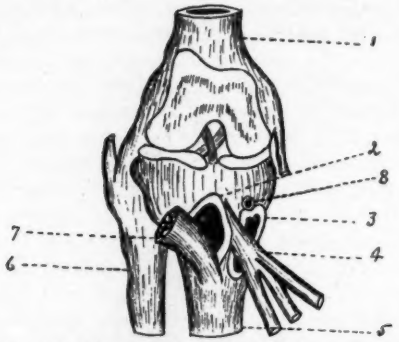

FIG. 2.—Bursæ about the knee. (After Debierre.) 1, femur; 2, pretibial bursa, 3, anserine bursa; 4, common tendon sartorius, gracilis, and semitendinosus; 5, tibia; 6, fibula; 7, ligamentum patellæ; 8, sartorial bursa.

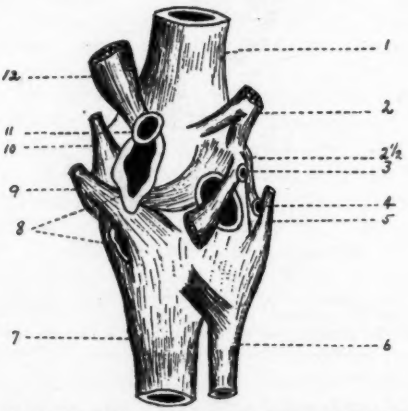

FIG. 3.—Bursæ about the posterior aspect of the knee. (After Debierre.) 1, femur; 2, gastrocnemius; 2½, external lateral ligament; 3, bursa of external lateral ligament; 4, bursa of biceps; 5, biceps; 6, fibula; 7, tibia; 8, bursa of semimembranosus; 9, semimembranosus; 10, gracilis; 11, bursa of gastrocnemius; 12, gastrocnemius.

they often communicate with other bursæ but never with a joint. Their variations in number and dimensions often bear some relation to the profession of the subjects. Sometimes they contain the fatty foreign bodies observed by Luschka. The subaponeurotic (or

median) prepatellar bursa lies between the fascia lata and the fibrous expansion of the two vasti muscles. It is present in from 75 to 95 per cent. of the cases (Poirier[29] and Bize), and is always single. Sometimes it communicates with the superficial bursa, and occasionally with the deep. The subtendinous (or deep) prepatellar bursa is small, often absent, and lies between the lateral

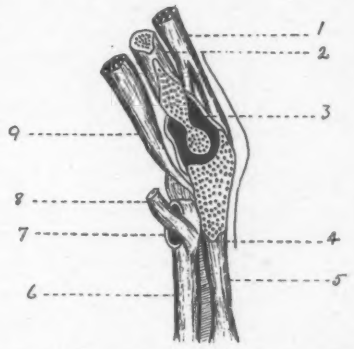

FIG. 4.—Bursæ about the elbow. (After Debierre.) 1, triceps; 2, humerus; 3, joint cavity; 4, bursa cubitalis interossea is frequently found at this site; 5, ulna; 6, radius; 7, bursa bicipitoradialis; 8, biceps; 9; brachialis anticus.

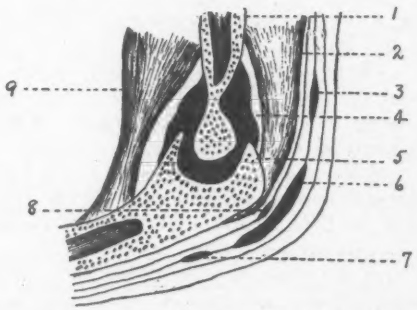

FIG. 5.—Bursæ about the elbow. (After Delord.) 1, humerus; 2, triceps; 3, supraolecranal bursa; 4, joint cavity; 5, ulna; 6, subcutaneous retroölcranal bursa; 7, infraolecranal bursa; 8, subaponeurotic retroölecranal bursa; 9, brachialis anticus.

muscular expansions of the quadriceps and the patella. The superficial subpatellar or pretibial bursa (Fig. 1, *4*) lies in front of the insertion of the patellar ligament into the tuberosity of the tibia. Its dimensions are variable and in about half of the cases it is replaced by a loose, areolar tissue. The deep subpatellar

[29] Bourses séreuses du genou, Arch. gén. de méd., 1886, pp. 539 and 694.

bursa, or bursa of the patellar ligament (Fig. 1, *5*) lies just above the insertion of this ligament, between its posterior surface and the bone. It is constant and its superior wall is usually in contact with a lobule of perisynovial fat. According to Poirier, it never communicates with the joint. The bursæ of the posterior and lateral aspects of the knee all lie in intimate relation with ligaments or tendons, and their sites are shown in the accompanying sketches (Figs. 2 and 3). Two almost constant bursæ, not represented in these drawings, are the inferior and superior bursæ of the internal lateral ligament, which lie between that ligament and the bone. The upper of these rarely, the lower never, communicates with the joint cavity. One of the lateral and posterior bursæ requires separate mention as of importance in connection with syphilitic bursopathies.

The Anserine Bursa (Fig. 2, *3*). This is the largest of the bursæ mucosæ at the internal lateral region of the knee, and has been, in two cases in which the site of the affection is carefully mentioned, involved in syphilis. The bursa was first described by Albinus. Its presence is constant, but it varies in size and form. It lies between the tibia (covered with the expansions of the internal lateral ligament) and the common tendon of sartorius, gracilis and semitendinosus. Within its cavity fibrous lamellæ are often found, dividing it into still smaller cavities; these indicate (Poirier) the origin of the anserine bursa by fusion of several bursæ belonging to each one of the three members of the common tendon.

Bursæ of the Elbow. These are shown in Figs. 4 and 5, and they all lie, as will be seen, in connection with the biceps and triceps muscles. Those at the posterior aspect of the elbow are of more importance in connection with syphilis than the well-known bicipitoradial bursa. They lie on two planes (Delord); that is, between the superficial fascia and the aponeurosis of the triceps (subcutaneous retroölecranal bursa, Fig. 5, *6*), or under this aponeurosis (subaponeurotic retroölecranal bursa, Fig. 5, *8*). The superficial bursæ lie behind, above, and below the olecranon (see Fig. 5), and may communicate with one another.

At the wrist and the ankle the chief bursæ of interest as regards the occurrence of syphilis are those in connection with the dorsal tendons. It was, indeed, a bursopathy in this site to which Verneuil first called attention.

Clinical Features. A thorough search of the literature reveals the reports of twenty-eight cases of syphilitic bursitis. The clinical features of these I have tabulated (see Table), and it is unnecessary to give their histories further. In two of these cases (Case XIII and Case XXII) there is room for considerable doubt as to the nature of the condition present. Moreau's patient (Case XIII) had a purulent bursitis (which is in itself strongly against its syphilitic origin); it was incised and cauterized, so that there is no evidence

that it yielded to the specific treatment also given; and it lasted four and one-half months, which is not the usual course of well-treated syphilitic bursitis. In Finger's patient (Case XXII) the history is not very complete, and it is not definitely stated that the disease originated in the bursæ. These two cases have been disregarded in the subsequent analysis. Several of the other reports are by no means complete; in two of them (Cases XXIII and XXIV) the patients passed out of observation before cure had occurred. These cases are, however, included in the analysis, as their syphilitic origin seems pretty well established. There are also in the literature other cases reported as luetic bursitis, the nature of which is too doubtful to warrant their inclusion in this table, but of which some mention should be made.

Verneuil reported a man with a syphilitic history who showed a symmetrical gummatous bursitis "in the neighborhood of the knee." There was no joint involvement. The lesion ulcerated. Neopolitan ointment was used locally and potassium iodide internally. The result is not stated. His third case, in the *Gazette hebdomadaire*, January, 1873, is also too briefly reported to pass muster. The patient was a woman with an ulcerating gumma at the internal condyle of one humerus, who showed the scars of an old, severe, ulcerating syphilide. There was no joint involvement. Nothing is said about the treatment or outcome of the case.

Keyes' Case VI (a woman, aged twenty-eight years, with an ulcerating syphilide on both knees and wrists, showing a fluctuating enlargement of both prepatellar bursæ which decreased in size under potassium iodide internally) may well have been one of bursal involvement by extension from the cutaneous lesions. In his Case VII treatment was not followed long enough to demonstrate the luetic origin of the condition. (The patient was a woman, aged fifty-two years, with a tubercular syphilide and an indolent swelling of both prepatellar bursæ.) The cases of Briddon and of Briddon and Taylor (cited by Keyes) are too doubtful to warrant consideration.

In the first case of Mauriac,[30] a man, aged thirty years, forty-two days after the appearance of a chancre, developed an acute and very painful fluctuating tenosynovitis of the extensor tendons of the hand. The case was regarded by Mauriac as one of syphilis, but all the signs and symptoms were those of a gonorrhœal tenosynovitis; and an adhesive involvement of the tendons persisted after the acute inflammation had subsided. This does not occur in syphilis. His second case was also undoubtedly one of gonorrhœa, though the possibility of syphilis was discussed.

[30] On Synovitis of Tendons Symptomatic of Syphilis and Gonorrhœa (translated by Cadell), Edinburgh Med. Jour., xxi, pp. 270 and 448.

Case reported by	Sex, age, occupation.	Evidences of syphilis.	Bursa involved. Form of bursitis.	Pain and other inflammatory signs	Joint involved. Functional disturbance.	Treatment.	Duration.		Remarks.
							Before treatment.	After treatment.	
1. Verneuil	Female	Secondaries present	Extensor com. dig. right wrist; hygroma	Slight pain and tenderness	Simultaneous arthritis shoulders and elbows; slight functional disturbance	Specific; kind and duration not stated	Not stated	Prompt cure	
2. Verneuil	Female; 34; dressmaker	Alopecia; mucous patches on vulva	Extensor com. dig. both wrists; hygroma; symmetrical	Slight pain; no others	Simultaneous pain in right arm and left foot; slight functional disturbance	Proto-iodide for 15 days	5 days	18 days	
3. Verneuil	Female	Definite secondaries	Extensor com. dig. both wrists; symmetrical; hygroma	Slight pain; no others	Simultaneous arthralgia (site not stated)	Specific; kind and duration not stated	Not stated	Prompt cure	
4. Verneuil	Female	Definite secondaries	Extensor com. dig. both wrists; hygroma; symmetrical	Slight pain	No joint involvement or functional disturbance	Specific; kind and duration not stated	Not stated	Prompt cure	
5. Verneuil	Male; 48; typesetter	Definite secondaries; bursitis; several mos. after chancre	Left retro-olecranal; hygroma	No pain or other signs	No joint involvement or functional disturbance	Mercury internally	1 week	1 month	
6. Finger	Male; physician	History of infection; secondaries; bursitis 4 months after chancre	Between rectus and subcrureus, right side; acute inflammation with effusion	Pain and tenderness	No joint involvement or functional disturbance	Sodium iodide internally	Several days	About 10 days	
7. Buechler	Female; 20; housemaid	Mucous patches and secondary rash	Left prepatellar; "fluid tumor without pain"	No pain; slight thickening of skin	No joint involvement or functional disturbance	Biniodide of mercury and potassium iodide	4 days	22 days	
8. Lang	Male; 56	Chancre and roseola	Right semimembranosus; hygroma	No pain; slight tenderness	No joint involvement or functional disturbance	Specific; kind not stated	Not stated	4 weeks	
9. Chouet	Female; 18	Mucous patches and other secondaries	Left prepatellar; crepitating hyperæmia without effusion	Pain, tenderness and crepitati n	Similar condition in knee-joint	Mercurial inunctions; Gibert's syrup	15 days	18 days	An acute crepitating bursitis during syphilis; the only case of tnis kind in the series.

10. Verneuil	Male; 32; locksmith	Clinical features of tertiary syphilis 8½ years after chancre	Left prepatellar; gummatous bursitis	Slight pain; skin discolored, adherent, thickened, and ulcerated	No joint involvement; discomfort on hyperextension of knee and on kneeling	Local specific; mixed internally	4 months	3 weeks	
11. Verneuil	Male; law-student	Chancre 5 years previously; rode horseback a good deal	Under tendon of semitendinosus, both sides; "fungous" bursitis	Slight pain; no other signs of inflammation	No joint involvement; slight embarrassment in walking.	Mercurial inunctions; potassium iodide internally	Not stated	6 weeks	
12. Moreau	Female; 34	History of syphilis; fell on knee	Anserine bursa; gummatous bursitis	None	No joint involvement; slight functional disturbance	Mercurial inunctions; potassium iodide and proto-iodide internally	6 weeks	4 weeks	
*13. Moreau	Male; 64; baker	Luetic history; chancre 40 years previously; rupia present	Over left internal malleolus; purulent; later "fungous"	Tenderness and reddening of skin	.....	Incision and cauterization; mixed treatment internally	Not stated	4½ months	
14. Moreau	Male; 33	Chancre 6½ yrs. previously	Dorsal surface of little toe; metatarsophalangeal joint great toe; left side; ulcerating	Tenderness and ulceration	No joint involvement; functional disturbance	Potass. iodide; proto-iodide; sparadrap of Vigo	About 12 months	3½ weeks	Simulated perforating ulcer.
15. Moreau	Male; 33; laborer	History of lues; luetic periostitis present	Palm of hand, level second metacarpal gummatous	Skin reddened; no pain	No joint involvement or functional disturbance	Potass. iodide internally; Neapolitan ointment	Not stated	3 weeks	
16. Moreau	Male; 34	Chancre 7 years previously	Right retrocolecranal; gummatous, then purulent, then fungating	Skin ulcerated after incision	No joint involvement; marked functional disturbance	Potass. iodide internally; Vigo plaster	8 years	Few weeks	
17. Keyes	Female; 48; housewife	Chancre 2½ yrs. previously	Both prepatellar; gummatous	No pain; slight adherence of skin to old scars of eruption	No joint involvement or functional disturbance	Potass. iodide	8 years	5 weeks	
18. Keyes	Female; 30; scrub-woman	Chancre 5 years previously	Both prepatellar; gummatous and ulcerating	No pain; reddening and ulceration of skin	No joint involvement or functional disturbance	"Antisyphilitic"	Not stated	4 months	
19. Keyes	Female; 33;	Iritis; mucous patches	Prepatellar (side?); gummatous and ulcerating	Slight pain; ulceration of skin	Slight stiffening of joint; osteoscopic pains	Not stated	Not stated	Not stated	These bursopathies had been present before and had disappeared under treatment.

Case reported by	Sex, age, occupation.	Evidences of syphilis.	Bursa involved. Form of bursitis.	Pain and other inflammatory signs.	Joint involved. Functional disturbance.	Treatment.	Duration.		Remarks.
							Before treatment.	After treatment.	
20. Keyes	Female; 40; housewife	Luetic history: miscarriages; nodules on shins	Both prepatellar; bursæ "thickened"	Slight pain; no other signs	Some interference with walking; no joint involvement	Not stated	Not stated	Not stated	These bursopathies had been present before and had disappeared under treatment.
21. Keyes	Female; 24; housewife	Chancre 18 mos. previously; secondaries present	Right prepatellar; acute inflammation with effusion	Pain; skin tender, red, and hot	Interference with walking; joint not involved	Potass. iodide	6 weeks	Prompt improvement	An acute inflammation which promptly cleared up under specific treatment.
*22. Finger	Female; 41	Signs of lues, but no history of it	Left prepatellar and over left coracoid; gummatous, ulcerating bursitis	No pain; skin discolored and ulcerated	No joint involvement	Kind not stated	3 years	2 months	
*23. Buechler	Female; 28; housewife	History of lues; gummata ecthyma; chancre 3 years before	Both pre- and infrapatellars; "hard, board-like tumor"	None	None	Potass. iodide	.....	Case not followed to cure	
*24. Buechler	Female; 35; housewife	Gummata present	Right prepatellar; "hard fibrous"	Pain; no others	None	Potass. iodide	Not stated	Not stated	Case passed out of observation; ulcerated under treatment.
25. Buechler	Male; 34; merchant	Chancre 31 mos. previously; syphilides (tertiary)	Right subpatellar; "elastic pseudo-fluctuating"	None	Slight stiffness of joint	Potass. iodide	Not stated	4 weeks	Chancre (as in other cases reported by Buechler) had been treated. The bursa healed readily, but the other syphilitic manifestations were most obstinate.
26. Labarthé	Male; 27; joiner	Chancre 7 years previously	Radial border, first phalanx fore-finger right hand; gummatous	No pain; skin slightly discolored	None	Mercurial inunctions; potass. iodide internally	3½ months	About 1 month	A bursa often exists at this site in joiners, but Labarthé excluded professional hygroma on the absence of pain, tenderness, and fluctuation.
27. Churchman	Female; 29; housewife	Gummata and circinate syphilide	Both prepatellar (hygromata) right retroöleocranal (gummatous)	Slight pain in left knee when kneeling; no other signs	None	Bichloride of mercury and potass. iodide internally	2½ years	About 1 month	The exact date of disappearance of the bursitis patient could not state.

NOTE.—The asterisk indicates a doubt as to the syphilitic nature of the bursitis. Cases 13 and 22, though reported as syphilitic, can not be so regarded with any certainty. Cases 23 and 24 were probably sypnilitic, though they were not followed until cure had taken place.

Voisin (Observation II) mentions a case of right tibiotarsal subacute syphilitic arthritis with tenosynovitis "des orteils" on the same side. No further data are given.

Gosselin[31] reported a case (Observation II) of an hysterical girl with a luetic history who developed a flexion of the knee and tenderness at the internal tuberosity. There was a fine crepitation present in the prepatellar bursa, which could be elicited by causing the skin to slide over the patella with the palm of the hand. The possibility of its luetic nature was discussed, but no conclusion was reached, and the ultimate fate of the patient is not stated. Volkman[32] describes a case of bursitis which he treated by a Schmierkur, but says nothing of its luetic nature. Zeissl mentions a case of bursitis of the left knee with a large effusion, which disappeared under antiluetic treatment.

The clinical features of the twenty-six certain cases here tabulated may be analyzed as follows:

Stage of the Syphilis. Nine of the cases occurred in the secondary, seventeen in the tertiary stage. The date of the occurrence of the lesion after the chancre varied from four months to eight and a half years.

Sex. Sixteen of the patients were women, ten were men. In twelve of the females the bursæ about the knee were involved—the anserine bursa once, the prepatellar bursæ eleven times. In the remaining four (the original cases of Verneuil) the extensors of the fingers were the seat of the trouble. In the males there was no such preponderance of prepatellar involvement. The anserine bursa was involved once, the semimembranous bursa once, the subpatellar once, the prepatellar once, and the bursa between the rectus and subcrureus once.

Age. The patients varied between eighteen and sixty-four years of age. The average age was about thirty-four years.

Profession of the Patient and History of Trauma. In 17 cases either there is no mention of trauma or it is distinctly stated that none had occurred. Of the 11 prepatellar cases in women, those who reported the cases could cite trauma as the exciting cause of the bursitis in only 3 patients. Of these 11 women, 9 did housework; the occupation of 2 is not stated. In some of the cases connection with trauma as an exciting cause was definite. Case XI, for instance, developed a luetic bursitis in the anserine bursa after excessive horseback riding; Case XXVI developed the condition in one of the professional bursæ of joiners. It is to be remembered that the affection is essentially indolent and that the patients would therefore be unlikely to connect it with previous insult, which might account for the absence of traumatic history in some of the cases. It is certain that the disease develops most often in bursæ most

[31] Archives générales de médecine.
[32] Berlin klin. Woch., 1876, No. 8.

exposed to trauma—one of its features which corresponds with the general habits of syphilis.

Pain was present in 16 cases, absent in 10, great in only 1 (Case IX). In the great majority of the cases it was an almost negligible feature. Functional disturbance was never marked, and in many cases was entirely absent.

Signs of Inflammation. In 15 cases there were none. Tenderness and discoloration of the skin were occasionally observed, and ulceration was present in six cases. Three cases showed definite acute inflammatory signs. In Case XVIII the skin over the left prepatellar bursa reddened, and ulceration took place. In Case XXI there was pain and tenderness in the bursa, with rise of local temperature.[33] Case IX showed a typical crepitating tenosynovitis, with pain and tenderness. In Case VI the condition was described as an "acute inflammation with effusion," and tenderness was present.

Joint Involvement. The joint neighboring on the involved bursa was involved only once (Case IX); here a condition similar to the bursitis existed in the knee. Three others showed co-existent arthralgia in distant joints; and one suffered from osteocopic pains. In general, joint involvement was conspicuous by its absence. This is quite at variance with the statement of Lang and Ullmann[34] that syphilitic affections of tendon sheaths, tendons, and bursæ are often met with in connection with joint changes; and with that of Voisin,[35] that "in the secondary stage, a subacute arthritis occurs which may involve many joints and *many subcutaneous serous bursæ or tendon sheaths at the same time.*"

The bursitis was *symmetrical* in nine cases, multiple in two.

Duration. Before treatment was begun the duration of the bursitis varied from four days to eight years. Treatment was almost always promptly effectual; in one case the bursitis persisted five months, but the disease disappeared on the average forty-six days after treatment was started.

Bursæ Involved.[36] The site of the bursitis was as follows:

[33] The pain in this case was regarded by Keyes, who reported it, as due in part to an hysterical hyperesthesia.

[34] Ergebnisse der allg. Path. u. Path. Anat., iii, 306.

[35] Loc. cit.

[36] Several other cases of *tendon* involvement are recorded by Chouet, Fournier, and Schuchardt. As these are cases of syphilitic tenosynovitis and not of bursitis, they are not included in the table. The tendons affected were the extensor longus digitorum, peroneus tertius, biceps femoris, biceps brachialis, etc.

Prepatellar bursa:		
Right	4	
Left	3	
Both	5	
Side not stated	1	13
Subpatellar bursa		2
Semimembranosus bursa		1
Between rectus and crureus		1
Anserine bursa		2
Bursa of extens. comm. dig.		4
Bursa of extensors of toes		1
Bursa of flexors of fingers		1
Bursa at radial border first phalanx forefinger		1

Form of Bursitis. Simple hygroma occurred eight times, only once (the author's case) in the tertiary stage. Gummatous bursitis was present ten times; ulcerating or fungous bursitis five times, acute inflammatory bursitis three times.

The picture, then, is one of an indolent affection of the bursæ, involving most often the knees—particularly in women. The disease is quite independent of syphilitic arthritis, the bursæ involved being oftenest those unconnected with the joints, and the neighboring joints themselves being entirely free from involvement.[37] *In the secondary stage simple hygroma is frequent; in the tertiary stage, gummatous, ulcerating, and fungous forms occur. The bursæ involved are those most exposed to trauma; but a study of the cases makes it clear that trauma, as usual in syphilis, only determines the site which the disease will occupy. There is little or no accompanying functional disability; and specific treatment leads to a prompt and permanent cure.*[38] *In view of the marked indolence of the condition and its great similarity to the arthropathies of syphilis, it should be spoken of as luetic bursopathy (of Verneuil)—the possibility of the rare occurrence of more acute symptoms being, however, kept in mind.*

DIAGNOSIS. The diagnosis rests on the following factors: (1) Previous history or co-existent signs of syphilis. (2) Spontaneous development of bursopathy, without particular traumatic history. (3) Slow evolution and chronic course. (4) Marked absence of pain, tenderness, and functional disability. (5) Symmetry of the bursopathy. (6) Site. An indolent bursopathy of the retroölecranal or prepatellar bursa—particularly if symmetricaal—should always arouse suspicion. (7) Absence of other causes of bursal enlargement (tuberculosis, trauma, hysteria, etc.). (8) Absence of joint involvement. (9) Inefficiency of non-specific, and complete efficiency of specific treatment.

DIFFERENTIAL DIAGNOSIS. An etiological tabulation of bursitis—constructed from the reported cases—may be of value in this connection:

[37] To this there is one doubtful exception in the table.

[38] In one case reported by Buechler the bursopathy promptly disappeared under treatment, but the other signs of syphilis persisted.

1. Traumatic bursitis:
   (*a*) Acute.
      I. Simple congestive bursitis.
      II. With effusion.
      III. With bloody effusion.
   (*b*) Chronic.
      I. Simple serous.
      II. Proliferating.
      III. Calcareous.
2. Inflammatory bursitis by propagation from neighboring infections.
3. Bursitis due to diatheses (many of these cases were mentioned by the earlier writers; quite possibly a number of them were syphilitic):
   (*a*) Rheumatism.
   (*b*) Gout.
   (*c*) Saturnism.
   (*d*) Hydrargyrism.
   (*e*) Scurvy.
   (*f*) Cholera.
4. Infectious bursitis:
   (*a*) Tuberculosis.
      I. Serous.
      II. Caseous.
      III. Fungous.
      IV. Accompanied by rice bodies.
   (*b*) Typhoid fever.
   (*c*) Pneumonia.
   (*d*) Mumps.
   (*e*) Grip.
   (*f*) Syphilis.
      I. Secondary.
         Congestive.
         Effusive.
      II. Tertiary.
         Gummatous.
         Ulcerating.
         Fungous.
         Effusive (rare).
   (*g*) Gonorrhœa.
   (*h*) Pyohemia.
   (*i*) Erysipelas.
5. Professional bursitis.
6. Positional bursitis (seen in epilepsy, long invalidism, in deformities of the extremities, etc.).

From the acute inflammatory cases syphilitic bursopathy is distinguished by its indolent character, its insidious onset and

chronic course, and its prompt response to specific treatment. From tuberculosis the diagnosis, particularly in the ulcerative cases, may be extremely difficult. I have recently seen a case of right prepateller bursitis in a colored woman, with thickening of the bursa and ulceration. The case was regarded as one of tuberculosis, and the bursa was excised. The ulcerations were certainly very suggestive of syphilis, and at operation the gross appearance was that of gummatous bursitis. Microscopic examination showed a chronic inflammatory bursitis without tubercles. The sections were stained for spirochetæ, and none were found. No tuberculin had been given, and the history was perfectly negative for syphilis; for these reasons the case is not reported as a gummatous bursitis, and is only mentioned as illustrating the difficulty of distinguishing between tuberculosis and syphilis. The diagnosis, however, should be made if the obvious steps are taken (tuberculin reaction, examination of smears for spirochetæ).

Professional bursopathies—particularly housemaid's knee—may simulate syphilitic bursopathy in all respects, and the diagnosis will often rest entirely on the therapeutic test.

Osteitis and periostitis may simulate the rare cases of acute syphilitic bursitis. If careful attention, however, is paid to the exact seat of the condition and the anatomical situation of the bursæ is kept in mind, the diagnosis can usually be made.

When the involved bursa is situated over the tendons of the extremities, the appearance may suggest a perforating ulcer. This occurred in Case XIV, reported by Moreau.

PATHOLOGY. The practically complete absence of postmortem and microscopic examinations makes it necessary to study the pathology of luetic bursopathies entirely from the clinical features. The disease occurs in the following forms:

1. Luetic bursopathy accompanying luetic arthopathy. Here the effusion of "syphilitic white swelling" spreads into bursæ which communicate with the joint (*e. g.*, the subquadriceps bursa), and the condition is simply a complication of the joint involvement. As such, it is quite unimportant; the wonder is that it does not occur oftener. But more curious still is the fact that, in connection with luetic arthropathies, the true bursæ mucosæ (unconnected with the joint) are almost never—so far as the evidence in the literature goes—involved in the disease.[39] Luetic bursopathy is an independent affection.

2. Luetic bursopathy, independent of luetic arthropathy. This occurs in three forms.

(*a*) *Congestive Bursitis.* Fournier has insisted that the vague "joint" pains so frequent in syphilis are often due to involvement

[39] There is one autopsy on record, made by Lancereaux, in which, in connection with a syphilitic knee-joint, the "pretibial bursa was occupied by a gummatous deposit." It is possible that such a finding is not rare, though the literature is silent on the point.

of the bursæ of tendons, and for the reason that careful examination of the site of the pain, of the movements which elicit it, and of the direction along which it is transmitted, often establishes its independence of the joint and points to its seat in the tendons. An acute syphilitic tendovaginitis undoubtedly exists. More nearly related, however, to the true luetic bursopathies are the rare cases of acute inflammation of bursæ mucosæ (see Cases IX and XXI), in which the signs are those of congestion with slight effusion.

(*b*) *Hydrops or Hygroma.* This is the most frequent form of luetic bursopathy in secondary syphilis; but the condition offers no special pathology in syphilis. The "effusion" consists of a yellowish, viscid, cloudy, coagulable fluid. No examination of it has ever been made for spirochetæ. Is it inflammatory in origin? Langemak[40] in giving an account of the origin of hygromas, states that the contents of the hydropic bursæ consists of fibrinoid,[41] which results from the solution of the previously undissolved albuminoid collagen, which has been heaped up in the bursa as a result of arterial hyperemia. The origin of hygromas is to be found in the liquefaction of increased connective tissue. This, indeed, is the view held by many investigators. The process begins, according to Schuchardt[42] with a hyperplasia of the fixed connective tissue elements. Numerous mitotic figures appear in the connective tissue cells, the cell bodies swell to an enormous size, and thus large multiform (but usually spindle-shaped) cells are formed. The cellular swelling continues, usually with loss of the nuclei, and peculiar amorphous vitreous structures result. This process is accompanied by a secretion of "Faserstoff," partly within the altered connective tissue cells, partly between them—but always within the tissue itself, and never on the free surface of a space. In the case of the bursæ mucosæ the inflammatory process takes place in the connective tissue surrounding the structure. There is no exudation from the free surface of the bursa. Ricker[43] has reached similar conclusions. The connective tissue elements which immediately precedes the liquefaction he finds to stain yellow, not red, with van Gieson's stain. The fluid comes from a change in the connective tissue, and not from the bloodvessels. All the products of degeneration mix with the liquid and cause further solution. Two types of liquefaction occur—the ganglion or gelatinous type and the hygroma type. These processes are essentially similar, but slightly different in detail. Even in the so-called inflammatory hygromas the process is one of degenerative liquefaction.

[40] Die Entstehung der Hygrome, Archiv für klin. Chir., 1903, lxx, 946. Nachtrag to the above, Ibid., lxxi, 268.

[41] "Fibrinoid" was the term used by Neumann to describe a degeneration product of connective tissue which stains yellow (*not* red) with van Gieson's stain, and is thought to be a transition form between fibrillary connective tissue and fluid.

[42] Die Entstehung der subkutanen Hygrome, Virchow's Archiv, 1890, cxxi, 305.

[43] Die Verflüssigung der Bindegewebsfasern, Virchow's Archiv, 1901, clxiii, 44.

Ritschl,[44] studying the pathogenesis of the ganglion, reached the similar view—previously advanced by Ledderhose—that the condition is one of degeneration and not of inflammation. Contrary views find expression in the literature;[45] but the great majority of the best work is in line with the degenerative theory of the origin of hygromas.

It is obvious that in these descriptions of the formation of hygromas it is not explained just how liquefaction takes place or what stimulates it; and it is not easy to conceive of such a process as entirely spontaneous. The important points seem, however, to be that the process is quite different from that of inflammation as ordinarily understood; that the fluid produced is unlike the usual exudates; that the connective tissue bears an important relation to its production; and that degeneration plays an essential role in the process.

(*c*) *Gumma of the Bursa.* This is the most frequent form of the disease in the tertiary stage. Frequently it goes on to ulceration. In Case XVIII both prepatellar bursæ were involved in a gummatous process; the right bursa ulcerated, but on the left side the affection was kept in check by treatment and no ulceration occurred. The possibility that ulcerative syphilitic processes at the site of a bursa really originated in broken-down subcutaneous gummas, or even in periosteum or bone, must, of course, be kept in mind. This was probably the fact in Case VI of Keyes' table, and I have not included the case in my tabulation.

Luetic Bursophathies in Congenital Syphilis. To this subject, so far as I have been able to find, no attention whatever has been called in the literature; and, although there are intimations that the disease exists, convincing evidence is wanting.[46] This seems all the more strange in view of the fact that congenital syphilis causes in the joints themselves a condition (Clutton's disease) exactly similar, clinically, to the luetic bursopathies of acquired syphilis. Undoubtedly the spread of a joint effusion into the communicating bursa often occurs, is considered incidental, and is not mentioned by

[44] Beitrag zur Pathogenese der Ganglien, Beiträge zur klin. Chir., 1895, xiv, p. 557.

[45] See particularly the article of Riese: Die Reiskörperchen in tuberkulös-erkrankten Synovialsäcke, Deutsche Zeitschrift für Chirurgie, 1896, xlii, 1. This author writes: "All rice bodies in tubercular joints, tendon sheaths, and bursæ are in the last analysis, derived from a fibrin coagulation. Part of this results from coagula which are first formed in the synovial fluid, another part from deposits which are laid down on the wall of the synovial sac and have become partially organized by means of its cells." See also Kreuter: Ein Fall von Bursitis Subdeltoidea als Beitrag zur Hygromfrage, Deutsche Zeitsch. f. Chir., 1904, lxxii, 136. This author found in *his* case *no* fibrinoid in the sense of Neumann, but a lining of granulation tissue, rich in vessels; and the fluid present came, he said, from the blood. The condition was one, *i. e.*, of inflammation and not of degeneration.

[46] Lang and Ullmann (Ergebnisse der allgemeinen Pathologie u. Pathologischen Anatomie, 1896, Jahrg. iii, 307) quote Finger and Lang as authority for the statement that chronic hydrops of the tendon sheaths occurs in hereditary syphilis and may reach a high grade of development. They do not mention the bursæ mucosæ, and the literature is elsewhere similarly silent.

the reporter. In Dureuil's thesis,[47] for instance, a photograph of such a case is reproduced in which a communicating subquadriceps bursa is distended from a joint effusion, but no mention of bursæ is made in the text. It is striking that Clutton, in reporting his eleven cases of symmetrical synovitis of the knee, is equally silent. It seems hardly likely that if the bursæ about the knee, not connecting with the joint, *had* been involved they would have escaped his notice; and he certainly would not have failed to mention their involvement if he had observed it.

Diard,[48] reporting fifty cases of gumma in hereditary syphilis, makes no mention of the bursæ, but two of his cases deserve attention:

Observation XXV. (Case of Fournier at St. Louis Hospital.) A girl, aged twenty-five years, a virgin, with no signs of acquired syphilis. Patient's sister luetic. At sixteen, the patient developed a perforation of the palate; at eighteen, a large gumma appeared on the left shoulder, destroying part of the deltoid, down to the humerus, which could be felt beneath the skin. The lesion partially healed, but later recurred in situ. There were other signs of hereditary syphilis. Diard makes no mention of the bursa in this case; but the condition may well have started in the subdeltoid bursa.

Observation XLII. (Case of Leloir and Perrin, Annales de dermat., 1883.) Patient had a family history of lues. At fourteen, keratitis developed. At sixteen, a swelling appeared in the right popliteal space, as large as a walnut, not painful, sharply demarcated, and not adherent to the skin. The subsequent course is not stated. Here, too, there is nothing said about bursæ; but a bursa may quite well have been the site of the affection.

Three possible cases are also reported in the thesis of Saint Pierre.[49]

Case V (reported by Guterbock). A girl, aged six months, with cachexia and desquamation of the soles of the feet, presented large swellings about the elbows, which ulcerated, forming fistulas which led directly to the denuded humerus. On the anterior surface of the left tibia—about at the site of the pretibial bursa—there was a fluctuating tumor, thought to be a subperiosteal abscess.

Observation XVI. A man, aged twenty-seven years, presented a marked hydrarthrosis of the right knee, and the note is made that the patella was "notablement élargie."

Observation XIX. Double hydrarthrosis of the knees; "les culs-de-sac de la synoviale son largement distendus."

With the exception of these vague references, bursopathies receive no attention in the extensive literature of congenital syphilis. In

[47] Contribution à l'étude des pseudo-tumeurs blanches syphilitiques, Paris Thesis, 1880, No. 148.

[48] Les manifestations gommeuses de la syphilis hérèditaire tardive, Paris Thesis, 1901, No. 548.

[49] Contribution à l'étude des arthropathies de la syphilis hérèditaire tardive, Lyon Thesis, 1900, No. 107.

Fournier's lectures[50] no cases are mentioned, unless the bursæ were involved in some of the patients rather vaguely referred to as cases of "pseudo-tumeurs-blanches syphilitiques." Somma[51] does not include bursopathies in his comprehensive list of the effects of hereditary lues; nor does Ranguedat[52] mention them. Either the condition has been overlooked, or the striking fact is that though essential hydrarthrosis is a distinctive characteristic of congenital syphilis, essential bursal hygroma—which occurs in the acquired disease—is never seen in the hereditary form.

ALLIED CONDITIONS. Certain effects of syphilis in the joints themselves or in the peri-articular structures present a clinical picture so similar to that of syphilitic bursopathy that some account should be taken of them in this connection.

Syphilitic Arthropathies. Mention has already been made of the great clinical similarity between syphilis of the joints and syphilis of the bursæ; and of the striking fact that when the disease affects one it does not, as a rule, affect the other. Special account should, however, be taken of the symmetrical arthropathies of congenital syphilis. This disease has been particularly described by Clutton[53] who in his first paper reported eleven cases—all effecting the knee. The disease occurred between the eighth and fifteenth years, and was characterized by:

1. Its symmetry.
2. Freedom from pain.
3. Long duration.
4. Free passive mobility of the joints throughout the disease.
5. Co-existent signs of hereditary syphilis.

Attention was usually called to the knees by stiffness in one of them, which on examination was found to contain fluid; fluid was also present in the other knee, which after an interval of some months became similarly affected. The swelling was a flaccid one—due to fluid not under tension. Careful examination showed the joints other than the knees to be normal. Every case showed two or more signs of the Hutchinsonian triad. The swellings remained without alterations for several months; but specific treatment brought about a perfect cure—though not so rapid a one as in acquired syphilis. One case gave an acute history following a fall. Nine of the eleven cases were suffering from an active keratitis, and the following similarities between the two conditions were dwelt upon by Clutton: (1) Both knees and both eyes are affected, with an interval between the onset of the disease in the two sides. (2) The disease is chronic

[50] Leçons sur la syphilis hérèd. tardive, Paris, 1896.

[51] Su di una forma morbosa articolare per sifilide ereditaria, Gior. internas. de sc. med. Napoli, 1882, n. s., iv, 840.

[52] Des arthropathies dans la syphilis hérèditaire, Paris Thesis, 1883, No. 356.

[53] Symmetrical Synovitis of the Knee in Hereditary Syphilis, Lancet, February 27, 1886, p. 391.

in both cases. (3) In neither case does it produce any destructive changes. (4) In both cases a relapse is frequent, and neither condition is strikingly amenable to treatment. (5) The two conditions occur at about the same period of life.

Intermittent Hydrops. The great similarity between the clinical picture of this disease and that of spyhilitic hygroma of the bursæ suggests that certain of the symptomatic cases of joint hydrops may have been luetic in origin. Friedenberg has reported cases definitely due to syphilis; and it would seem wise, in all cases in which the etiology is not clear, to apply the therapeutic test.

Bicipital Serositis. This obscure condition—described by Notta, of Lisieux, under the name of contraction of the biceps—has been observed by several authors and its syphilitic nature asserted. Finger says positively that a tenosynovitis of the tendon of the biceps is particularly characteristic of secondary lues, and that it accounts for many of the vague pains felt at the elbow, the real site of which will be found on careful examination to be the bicipital tendon. And Fournier lays great stress on pain at the bend of the elbow with inability to extend the forearm as characteristic of secondary syphilis. But this syphilitic tenosynovitis, which is quite frequent, is different from the other rarer syphilitic affection at this site, which has its real seat in the bicipitoradial bursa. The condition is characterized by pain and tenderness in the bicipital tendon. The forearm is held slightly flexed and there is difficulty in extension. There is also and most characteristically painful embarrassment of simultaneous flexion of the forearm with supination of the hand. Complete pronation is impossible. The position of the arm and the interference with motion, so far as it is a mechanical affair, have been shown, by injection of the bicipitoradial bursa in the cadaver, to be due to effusion into this bursa. It is interesting that this condition was described by Colles,[54] who did not, however, lay any particular stress on it. "A very common form," he wrote, "of these affections" (joint and bursal effusions) "is observed in the elbow-joint; the patient has not full power of it, he cannot fully flex it, nor extend it much beyond a right angle; very rarely is there any pain or any tenderness from pressure when made upon the prominent parts of the joint. Not infrequently this affection of the joint is caused by effusion into some of the adjacent bursæ; but in all these cases we feel the tendon of the biceps extremely rigid, yet not swollen nor tender to the touch." Distention at this site may effect the radial nerve, as in a case reported by Walther, in which a radial paralysis, thought to be due to a neuroma, was found to be caused by a fibrolipoma of the bursa. It is probable that in some of the cases the cubitoradial bursa of Monro (lying between the tendon of the biceps and tuberosity of radius, and the external border of brachialis anticus

[54] Loc. cit.

tendon and fasciæ of flexor sublimis digitorum) is the one affected. In a case reported by Rieffel[55] there was difficulty of flexion of the forearm, and a walnut-sized tumor appeared at the site of the bicipito-radial bursa. There had been no trauma, and the swelling, which was free from tenderness, appeared suddenly. It was impossible to establish its luetic origin, and it was excised. It contained sero-sanguineous fluid. Weinlechner[56] reported a case of extensive swelling of this bursa—indolent in itself, but causing great interference with motion—which he excised. There is no note as to its luetic origin. Mauriac calls the affection syphilitic, so that some of his cases must have been of this origin; but detailed histories are not given. Indeed, the literature of the subject is so slim and inaccessible that conclusions as to the cause of the disease are impossible. Notta's article I have been entirely unable to find, and have relied on a reference to it in Cadell's review of an article by Mauriac. There seems to be, however, sufficient evidence for mentioning this condition in a consideration of syphilitic bursitis, and for applying the therapeutic test when cases of bicipital serositis occur.

Achillo Bursitis Anterior (*Achillodynie of Albert*). In 1893 Albert,[57] of Vienna, described an affection characterized by pain in the Achilles tendon near its attachment, with the presence of a swelling over the tendon just above the os calcis. Six cases were reported. In all the patients, walking and standing were impossible on account of the pain, which disappeared on lying down. Albert's pupil, Rössler[58] called attention, also, to the efforts made by these patients to keep the musculature of the calf lax by plantar flexion of the foot, and to the accompanying pronation of the foot, which led in time to flat-foot. He also showed, by anatomical studies, that the seat of the disease is the bursa lying between the Achilles tendon and the tuberosity of the os calcis. Heinecke[59] had, years before, mentioned a bursitis is this situation. "The anterior Achilles bursa,"[60] he wrote, is occasionally found to be the site of serous and crepitating inflammations; hygromata of this bursa also occur." Raynal[61] and Kirmisson[62] had also described, under the name "peritendinous cellulitis of the Achilles tendon," cases which may well have been due to inflammation of the subtendinous bursa. Pitha[63]

[55] Sur les affections de la bourse séreuse du biceps brachial, Bull. et mém. soc. de chir. de Paris, 1905, n. s., xxxi, 581.

[56] Bericht des k.k., Allgemein-Krankenhaus zu Wien, 1883, p. 262.

[57] Achillodynie, Wiener med. Presse, January 8, 1893, Jahrg. xxxiv, No. 2.

[58] Zur Kenntniss der Achillodynie, Deutsche Zeitschrift für Chirurgie, 1896, xlii, 274.

[59] Anatomie u. Pathologie der Schleimbeutel u. Schnenscheiden, Erlangen, 1868.

[60] The bursa is called "anterior" to distinguish it from an inconstant bursa found about one and one-half inches above the Achilles insertion, lying between it and the fascia. Superficial and deep, or subfascial and subtendinous, would be more accurate adjectives to apply to these bursæ.

[61] Cellulite peri-tendineuse du tendon d'Achille, Archives gén. de méd., 1883.

[62] Ibid., 1884.

[63] Krankheiten der Extremitäten.

regarded "partial evulsion of the insertion of the Achilles tendon" as the cause of an affection about the heel which Albert thought identical with the disease he himself described as Achillodynie.

Gout, tuberculosis, rheumatism, but particularly gonorrhœa, were given by Albert and Rössler as the causes of the condition. No connection with syphilis was mentioned; the possibility of its accounting for certain of the "rheumatic" and "gouty" cases does not seem to have been kept in mind. One patient (that of Weinlechner, reported by Rössler) presented a symmetrical, indolent hygroma of both anterior Achilles bursæ, which had appeared spontaneously—a picture strikingly like that already described for syphilitic bursopathy. The case was regarded by Rössler as one of "bursitis deformans." It is to be remembered that before this condition was described by Albert, pain in the Achilles tendon had been noticed in connection with syphilis (see Keyes).

CHOREA A SYMPTOM—NOT A DISEASE.

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One of the most common conditions with which we have to deal at St. Mary's Free Hospital for Children is what is known as chorea. We admit about 50 cases annually, and always have some cases in the wards under treatment. It follows that the subject of chorea is constantly in mind, and commands the attention of those in charge. During the early years of my service at the hospital, begun twenty-three years ago, the idea was that chorea was a peculiar disease of the nervous system; that it was associated in some unexplained way with rheumatism and endocarditis, and was to be treated and cured by increasingly large doses of arsenic. I venture the opinion that this today represents the general idea of the ordinary medical student or recent graduate, and perhaps of some others.

By following the arsenical plan of treatment, within two years I had caused three cases of hemorrhage from the stomach, several cases of hemorrhage from the kidney, and many cases of severe irritation, if not inflammation, of the conjunctiva. I have seen also arsenical neuritis from this method of treatment. Two things became evident to me: one, that the arsenical plan of treatment, as I used it, certainly was too severe, and accomplished but little; and second, that most of the cases of chorea admitted to the Summer Home, at that time situated on Rockaway Beach, got well quickly

and without medication. Experiences like this made me believe that the then teaching concerning chorea could not be right, that the subject was not even as well understood as the text-books seemed to indicate. Recently American writers seem disposed to take a broader view, which I attribute to emancipation from the English writers, who look upon chorea as a serious disease, and probably rightly, since in England all rheumatic affections seem to be more serious than with us. Still the American writers have not, it seems to me, presented the condition correctly. To offer a satisfactory explanation of what is called chorea, one should be able to suggest a reasonable pathology; but since few cases are fatal, the conclusion must be in large measure theoretical.

The subject has formulated itself gradually in my mind in this way: The great mistake has been in regarding the occurrence of incoördinated muscular movements in the young as a disease, an entity. If we put the idea of a disease out of mind and look upon the incoördinated muscular movements as a symptom, or manifestation of some underlying condition, we immediately solve what has seemed a difficult problem. As a matter of fact, in practice we so regard it, and we treat it as a symptom. The causes of incoördinated muscular movements are many, and such movements we find in the old as well as in the young. In the old we consider these movements when occurring just prior to death, in the course of an arteriosclerosis, as due to faulty nutrition and failure of action of the motor control cells. The same sort of movements appearing in the course of a severe illness, a toxemia, or at a time of great stress, we also explain as due to faulty nutrition or lost action of the motor control cells; as due to poisoning of them, or due to their exhaustion by overaction. We do not consider the incoördinated movements as being a disease in themselves. Why, then, when such movements occur in children under certain conditions, should we regard them as due to something quite different? Especially when we know that the normal condition of childhood is constant muscular activity, and that anything that weakens the child naturally weakens the nervous control, and so may permit unrestrained muscular action. If we regard these incoördinated muscular movements as a symptom, or indication of some underlying cause, we frequently can present a satisfactory explanation of them. Such exciting cause may be anything, a condition, infection, or disease which will bring about a weakness, a disability, a malnutrition, or a degeneration of the motor control cells. Some individuals will succumb to such conditions more readily than others; some are predisposed; all cases will not be due to the same cause, nor will they pursue the same course. If we try to classify the cases in accordance with the more evident exciting causes, we put ourselves in the way of being able to treat them reasonably, and also supply as well a pathology of the condition. We also do away with the diagnosis "chorea," which is

in the same class as the diagnosis "convulsions," "jaundice," "dropsy"—a symptom only.

Gradually, in accordance with their cause, I have learned to separate several classes of cases having incoördinated muscular movements as a predominant symptom. These different classes demand modifications in treatment, and it is because of the need of modifications in treatment that I believe the subject is one of great importance. The largest number of cases of so-called chorea are readily divided into two classes, the main distinction being the presence or absence of an endocarditis, or other infective process.

Class I will comprise the many cases which occur in the spring or autumn months, most commonly in girls, and between the ages of seven to fourteen years. A great proportion occurs among those bright, nervously disposed individuals who strain and push themselves to keep up their standing in school, at the head perhaps of their class. They "run down," as the phrase is, lose sleep, eat badly, become anemic. We find the hemoglobin content of the blood is about 60 or lower. These children get into such a state of nervous fatigue, exhaustion, and irritability, that with an added physical or emotional shock, and many times without any such shock, the control centres lose their activity, their power, their balance. The resultant state is one of uncontrolled muscular movements, and that has been called chorea. In many individuals there exists a badly balanced nervous system and such children succumb more readily than do others. Most of these children have shown nervous irritability even as babies; many have tantrums readily; they easily lose control of themselves, but chiefly when tired physically, as from too long walks, too strenuous play, too hard study, too much worry, or too much irritation from any cause. The same sequence of events in an older child in whom the emotional nature is developing, or is the predominant one, is attended with loss of control over the emotions, and this is what is usually called hysteria. We think of such a state as due to nervous exhaustion, shock, the result of an illness, or some toxemia, and we try to establish nervous control by rest, by forced feeding, by diversion, or whatever will aid in restoring the exhausted nerve cells. In the younger child the muscular system is the developing one, and here nervous exhaustion is shown by loss of muscular control. I believe the two states, so-called hysteria in the young adult, and incoördinated muscular movements in the young child, are entirely analogous. The course of the two states is apt to be similar, but it is not regular. Progress and duration depend upon the individual nervous system, on the care received, and on the general recuperative capacity of the individual. In many children the two conditions occur together, loss of emotional and will control as well as loss of muscular control. In this way the changed mentality so frequently seen is accounted for. In some cases the loss of will control is greater than the loss of motor control; the varia-

tions are many; in general terms the conditions are those of nervous exhaustion, and should be treated as such.

Treatment. Such children should be put to bed in a quiet room, relieved of their anxieties, aided to sleep, and be stuffed with plain nutritious food. They also should be given tonics, as iron, arsenic (in small tonic doses), cod-liver oil, marrow, or mixed fats. During the acuteness of the illness the violent movements and restlessness frequently require the administration of quieting drugs, such as the bromides, codeine, trional, veronal, asafœtida, etc., but they should be for temporary amelioration of symptoms only. One should do everything that will aid in restoring the nerve cells to their normal state and function; in fact, give a sort of rest cure. In some cases the result of such treatment is a cure in a short time, particularly if the child can be sent to the country and have the benefit which that means to a city child in the way of air and quiet and freedom from fret. Other cases are very slow in their recuperation, as is the case with individuals after any illness. At St. Mary's the effort is always to keep a cheerful, happy atmosphere in the wards, and to practise, particularly with such cases as have an hysterical element present, a seeming neglect. The purpose of this is to try to keep the child's mind off itself. It is surprising how hysterical some young children can be. Our results with such principles of treatment are most excellent. I have carried out the same idea in the few cases met with in private practice, but the fact that I have seen but few cases of so-called chorea in twenty-five years of private practice, yet have seen many cases of nervousness, makes me more confident that my point of view is correct, for among intelligent parents the first indications of nervous fatigue and breakdown in their children are recognized, and the patients are removed from the sources of strain and placed in the best possible environment. This is something that is not done by the less intelligent parent, and cannot be done by the tenement house parent.

Class II will comprise the large number of cases due to infections; some cases have been caused by the malarial plasmodia; some cases have attended or followed pneumococcic infections, some have followed typhoid infections; by far the largest number are due to the rheumatic infections; and, since there are probably several different varieties of germs causing rheumatic infections, it is easy to understand why so many different germs have been separated and presented by observers as the cause of chorea. In many cases there is present a pericarditis as well as the commoner endocarditis, and I believe there also may occur an endarteritis of some of the cerebral vessels (this of course is theory). I consider that the incoördinated muscular movements are brought about in most of these cases, much as they are in the first variety, by the infecting process causing a profound anemia and malnutrition, or innutrition of the control centres, both motor and sensory

An endarteritis, as suggested above, may be the cause of this in some cases. Whatever the process may be, the important point to be recognized is, that the patient is under the influence of an infection, and should be treated accordingly. The development of an endocarditis is apt to be slow, and the development of the condition of lost motor and emotional control is also apt to be slow. If one is alert to notice such symptoms, he may be able to avert an attack by early treatment. Many cases first show irritability of temper and perhaps weakness of certain muscles, notably of the arm, and are apt to drop articles. In some cases in which an endocarditis is present there is pretty surely some myocarditis and a certain amount of cardiac dilatation, which in itself becomes a source of great nervous strain, unless the patient is properly cared for. The cardiac dilatation may readily follow an attack of so-called tantrums. This is not an uncommon occurrence in these children.

Treatment. Rest in bed is imperative and for an indefinite time. We should administer such drugs as overcome, or combat at least, the infecting germs; quinine, if indicated, sometimes arsenic, the different salicylates, and, probably, in large doses; and remove the ordinary channels of infection, as diseased tonsils, adenoids, decayed or decaying teeth, which are I am sure a common nidus of such infections. Such treatment should be kept up indefinitely, until normal temperature, blood tests, and general nutrition, physically, composure and happiness, mentally, indicate that the child is no longer under the influence of an active infection. No one can possibly tell the duration of such a condition. Meantime, one should not ignore the indications of the endocardium or the other membranes of the heart, or of the vessels. Of course, there are cases of the first class, that is, without infection, which are difficult to separate from the second class, because there will be in some cases cardiac murmurs due to anemia, and cases of dilatation due to the same cause. Fortunately the treatment of rest in bed applies to both classes, and if carried out can only do good. The harm arises from letting such patients run about and be subjected to the strain of ordinary life. I have little doubt that an immense amount of suffering has been entailed by allowing these little people to keep on their feet, because "they only have chorea." Any one who has witnessed the excessive irritability, both mental and physical, of nervous children when fatigued will understand what I mean. Under such conditions it is no unusual thing for the entire nature of the individual to be completely altered for days at a time. Not infrequently we have cases of acute endocarditis brought into the hospital with active choreic movements, in which, after a day or two of quiet rest in bed and sufficient sleep, the movements subside. There are all varieties of cases and all degrees of severity presented. The important thing is to recognize a condition of infection and not to be led to treat the symptom, due only to the processes caused by the infections.

Class III comprises the grave cases, so called chorea major, chorea insaniens, cases which are usually fatal, and which in my opinion are really cases of septic or malignant endocarditis. There have been two such cases with autopsies in my service at St. Mary's. In them the movements were of such violent character that the children were with great difficulty kept in bed, and it was impossible to take temperatures, or to make satisfactory examinations of the heart, but the diagnosis was made before death, and autopsy showed the lesions of septic endocarditis. Dr. B. Sachs[1] reports two such cases under the title "Grave Chorea and its Relation to Septicemia," and makes remarks which agree with much that I have said in this present paper; he too is evidently doubtful as to the entity of chorea, but still he does not get away from thinking of chorea as a disease in itself, and the main disease in the cases he reports; streptococci were demonstrated to be present in the blood of one of Dr. Sachs' patients during life; in both cases the lesions of septic endocarditis were found postmortem. I am sure we shall do better by recognizing the state as infectious or septic endocarditis with choreic movements. If such infectious diseases present in their course convulsions, or delirium, or jaundice, we do not think of such symptoms as the disease. I fail to understand why we should still continue to regard the class of cases to which I refer as chorea major or chorea insaniens or grave chorea. We simply blind ourselves to the real condition, and by teaching that there is such a disease as fatal chorea, we lead our fellow practitioner far astray and allow him to run the risk of failing to understand the true state and of giving his patient no intelligent treatment. I believe the whole idea of the illness has been wrong; the chorea is a subordinate element. To be sure, the outcome is likely to be the same whatever we call it, but one likes to treat even fatal diseases in an intelligent manner.

Class IV.—We have all been taught to regard what has been called Huntington's chorea as the one variety of chorea with a lesion. If one looks at it as due to arteriosclerosis affecting the vessels of the motor cells, one removes everything unusual about it. For there is nothing especially strange about the fact that some families have a tendency to degeneration of a certain set of cerebral bloodvessels. We are misled by the term chorea applied as describing a distinct disease, or a distinct variety of disease, but we are not surprised at the occurrence of incoördinated movements in the development of arteriosclerosis. Observers seem to have been impressed by the violence and largeness of the muscular movements, and have considered such movements the disease.

Class V.—No one probably questions the idea that so-called chorea gravidarum is due either to a toxic state or to nervous depression in a pregnant woman. We all certainly regard these movements as symptomatic only, and treat them so.

[1] New York Medical Record, March 28, 1908.

Other conditions, showing incoördinated movements in their development, doubtless occur. I trust that some observers will agree with me in the conclusion that these movements when occurring in the young also are symptomatic only; that our teaching concerning so-called chorea should be broadened; that it should not be that chorea is a disease per se and to be treated as such, but rather that the occurrence of the symptoms described under this old term should be studied with the view of finding the causative element, and that the treatment should be directed toward it.

THE PRACTICAL VALUE OF THE ASSOCIATION TEST.[1]

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The association test, or experiment, was converted into a practical aid in diagnosis when Jung discovered that a lengthening of the association time gave a clue to the subject's past emotional experiences. Prior to Jung, this variety of psychological analysis concerned chiefly the character of the correlated ideas which were aroused. Wundt blazed the trail with his external and internal association: Internal, in which the stimulus word and the reaction word are connected by the same idea—for example, desk-furniture; and, external, in which the two words are connected by time or place or sound—for example, stimulus, *hand*, reaction, *ring;* stimulus, *snow*, reaction, *country;* stimulus, *bell*, reaction, *tell*. Kraepelin, and especially Aschaffenburg, went farther with this line of inquiry in normal persons and in such pathological conditions as toxic states, maniac states, and exhaustion. In normal subjects, they showed that external associations exceed in ratio the internal. In the pathological states they demonstrated particularly that sound associations indicate a lowering of intellectual function. Ziehen also has shown that reaction words in children relate to what has been actually experienced by the child; for example, *water, swimming*, the child being fond of swimming; *insolent, Elizabeth*, Elizabeth not being a favorite of the subject.

The time element in associations had also been studied before Jung. Galton, in 1878, had measured association time, and this feature was also not the least of the results of the experiments of Kraepelin and Aschaffenburg. These latter showed that external associations are quicker than internal; that manic states have a lengthened association time, in spite of the flight of ideas, and that in alcoholism the associations are first quickened and later slowed.

[1] Read at a meeting of the Section on Nervous and Mental Diseases of the American Medical Association, Atlantic City, N. J., June 10, 1909.

But it remained for Jung to point out a hitherto unknown significance of lengthened association time. He found that a lengthened interval in one or more reactions in the series indicates that the stimulus word has touched upon an emotional complex, or a constellation of ideas which exists independently of volition and which is dominated by an emotion of some kind. This discovery immediately converted the association test into a practical and reasonably speedy method of psychic analysis. Previous methods were time consuming. Their results were general, revealing the characteristics of the disease or state, rather than of the individual.

The Jung test is primarily individualistic. The stimulus word, like the hunting dog, shows where an emotional complex is lurking. It shows what the subject likes and what he dislikes; where he has suffered and what has pleased him; what he regards as friendly and what as hostile; what he fears and to what he is indifferent. These biographical data come to light without the subject's knowledge and sometimes against his will, and furnish a rational basis for psychotherapy. Psychotherapy is a treatment by suggestion, by explanation, by persuasion, by a regulation of environmental influences. The physician's own experience and judgment furnish motives and points of view, delivered with the purpose of changing the patient's attitude toward himself and his surroundings. The association test furnishes the information indispensable for such psychic guidance so easily and quickly, and the test itself is so much less cumbersome than other methods of psycho-analysis, which require the use of instruments of precision, that it seems remarkable that it has not received more prompt adoption.

Scripture, Brill, and others have called it to the attention of the medical profession in this country. It is part of the routine examinations in several psychiatric clinics and laboratories, and is becoming a favorite topic in the magazines. But the physician generally seems to have passed it over. It has appeared to me worth while, once again, to call it to public notice, and to mention some instances in which it has proved useful.

The method is as follows: A list of one hundred current words (see Chart) is printed on a pad and so distributed that there is an alternation of nouns and adjectives, and every fourth word a verb. These words are printed in a vertical column, and between every three or four of them a space is left, so that if there seems to be a need of a word not on the printed list, it can be written in. Each word is numbered, so that it can be referred to by number without pronouncing the word. On the same horizontal line as the number and the word three spaces are left—one for the time record, one for the reaction word, and one for the reproduction, or the response which is given on the second trial. If the reproduced reaction is identical with the original reaction, it is indicated by +. The method is explained to the patient, and the words are then read to him.

Name.....

	Time.	Reaction.	Reproduction.
1 Head:			
2 Green:			
3 Water:			
4 To prick:			
5 Angel:			

Chart showing a convenient printed form for the association experiments. Note the blank space left for additional words.

This may be done by the physician, but is better done by some third person. The association time is taken by a $\frac{1}{5}$ second stop watch, and it and the reaction word, or the first word spoken by the subject in response to the stimulus, is entered in the space reserved for it. The second trial, or reproduction, generally necessary for suspicious words only, should be delayed for at least twenty minutes. Failure to reproduce has been shown to be evidence that the stimulus word has touched upon a complex. The sheet containing all the facts becomes a permanent record. The test gives its most brilliant results when it brings to light an emotional experience which is no longer a factor in the conscious life of the individual, but which, nevertheless, has started a chain of persisting symptoms. Ordinary history taking can hardly hope to reveal such buried psychic causes. An example is the following:

A man had suffered for seven years from tic convulsif. The closest questioning failed to show anything in his past career that might be regarded as of etiological significance. The association test showed, in general, prompt reactions. But the word *lung* took thirteen seconds for the reaction *man*. Questioning brought out that seven and one-half years previously the patient had been examined for life insurance, and declined by two companies in succession. The reason for rejection was pulmonary tuberculosis, of which the candidate had been ignorant. Shortly after this shock the convulsive movements began. The patient had no conscious association between the two occurrences.

Few of us are prepared to accept the theory of Freud that sexual traumas in childhood are the mainsprings of hysteria. But Freud's teachings have been of great value in pointing out that painful emotional experiences in children are responsible for many neurotic symptoms, which can only be overcome when the cause of them, long since perhaps passed from conscious memory, has been fully brought to consciousness. A lady had suffered practically all her

life from sudden feelings of weakness, from feelings of inadequacy and depression, and from occasional losses of consciousness. She was sent to me with the diagnosis of petit mal. Her associations were mostly prompt, that is, between 1.5 and 2.5 seconds. The following were exceptions:

To threaten	to anger	3.5	seconds	R., to paralyze
Water	bread	4.5	"	R., milk
Trapeze	rope	7.0	"	R., fall
Woods	fear	3.5	"	R., +
Journey	trip	4.0	"	R., faint
Sympathy	lack of sympathy	4.0	"	R., +
Procession	night	4.0	"	R., plight
Suicide	hell or fire	7.0	"	R., hell

The first four of these reactions had reference to events in childhood, the others to later experience. The reaction *to threaten, to anger, to paralyze,* brought her back to when she was a child of eight. A coachman, having enticed her to his room, took her on his lap, pressed her to him, kissed her, and then threatened to injure her if she ever told. *Water* recalled an experience, also in early childhood, when she saw her brother drowned; *trapeze,* when, also as a child, the rope of a trapeze she was on broke, giving her a bad fall; and *woods,* when she, with other little girls, was badly frightened by being told that Indians were behind the trees.

All of these were painful experiences, about which she rarely spoke. Her husband was the only person to whom she had mentioned the affair of the coachman. On the theory that they were concealed complexes which "mental catharsis" might mitigate, a companion was provided, and to the companion the patient talked very day on these painful subjects. The other complexes aroused, being of recent date, were not regarded as of causative significance. The effect of the free externalization was prompt and pronounced. The patient emerged from a life of invalidism to one of activity; she had no more petit mal attacks; and while she is still annoyed by some of the old nightmares, she is better than she ever has been since childhood.

The association experiment has proved of great use in the history taking of young adults beneath the surface of whose variegated nervous phenomena lurked a paranoid condition. The experiment itself did not finally fix the character of the paranoid state. Whether it was psychasthenic, or a beginning paranoia, or dementia præcox, had to be decided from outside considerations. But the complexes aroused pointed the way for inquiry, and revealed frames of mind which would have been difficult to reach in any other way or which might have escaped identification altogether.

A boy of twenty-one had always been eccentric, solitary, and at times depressed, but never had given expression to insane ideas. He was an only son, and did about as he pleased. He would change

his school frequently, and his education suffered. He refused to eat in his own house, and took his meals at a restaurant. He had various notions as to what was best for him, most of which were entirely erroneous. He was a problem for his family, who were utterly at a loss to explain his peculiar behavior. Confronted with the association test, he was prompt in his reaction. The following words were noted as suspicious:

Friendly	unfriendly	2.8 seconds	R., +
Insolent	ugly	2.5 "	R., unfriendly
Angry	foolish	3.2 "	R., ugly
Goat	billygoat	3.0 "	R., butt
Luck	chance	4.2 "	R., +
Estranged	to separate	3.4 "	R., fear.
Scorn	depart	4.6 "	R., despise.
Affection	hate	4.0 "	R., despise.
Chance	trial	5.2 "	R., luck.

In conversation about these reactions, he admitted that people were not friendly, that they were insolent, that their treatment made him angry, that he was estranged from his family, that he had no luck. The word *goat* brought out this embryonic delusion of persecution in a remarkable way. He said in regard to his reaction to that word that he could not help thinking of how often he had been made a butt at school and how unfriendly the boys were to him. The stimulus word *scorn* recalled a definite occurrence. The complex concerned dated from a period of great excitement, when he thought his family scorned and despised him, so that he decided to leave the house, *to depart*. He was prevented from doing so by his father.

In this case the test made clear that there was a slowly forming paranoid state, with convictions of injustice and feelings of resentment. To break them up, the patient was sent abroad in the companionship of a University man with psychological training. The instructions were that full and free conversation should be held on all unpleasant topics. These instructions were carried out. But it is interesting to record that after three months' intimate conversations, nothing had been added to the results obtained in one interview by the association test. The patient improved in deportment and spirits and lost most of his eccentricity. And the following year he did well at school, though far behind in his studies. But the fancies in regard to the esteem in which he was held by others never faded completely, and the chances seem to be that he must continue to suffer from a non-dementing delusional form of mental disorder.

In his monograph on dementia præcox, Jung has drawn a parallel between the emotional complexes of hysteria and those of dementia præcox. Both may be aroused by a stimulus word. But experience teaches that the complexes in dementia præcox are less accessible, more clouded; and in it a larger proportion of the

lengthened reaction times will remain unexplained than in a pure psychogenic disorder like hysteria.

I have in mind the case of a boy who wrote me: "I have not succeeded in what I most desired to attain, that of living the most normal life like other people of my own age. As long as I can remember, I have felt this deficiency, and wished to overcome it. This is especially in regard to other people. I have a sense of inferiority when with people of my own age, and do not seem to get the respect they give each other. From this I get an idea that I am alienated from them. I have never made a warm friend of my own age, and I got an idea that people were unfriendly and I could not get on with them."

This from a lad, aged seventeen years; one also who lacks initiative except when he flies into violent rages and who has never profited from any discipline; one who for two years past has constantly complained that something was wrong with him, that people were talking about him, that no one liked him. The clinical diagnosis was dementia præcox, and the association test confirmed the general trend of the outlined mental attitude. For example:

Friendly	man	12.0 seconds	R., unkind.
Insolent	manner	14.0 "	R., failed.
Sick	feeble.	11.0 "	R., will.
To threaten	angry.	6.0 "	R., anger.

But in addition to these emotional reactions, which agreed with the general mental tone of the patient and which were decipherable, there were many other lengthened reactions, the causes of which all inquiry failed to disclose. And this fact, that together with some complexes of paranoid type there were others, many of them, which eluded analysis, strengthened the diagnosis of dementia præcox.

There is a class of patients in whom the association test seems to give little useful information. These suffer from a form of nervousness which is the product of the times and environment. Domestic unhappiness, disproportionate wealth, idleness, all acting on limited brain equipment, fail to produce that beauty in the inward soul which Socrates prayed for. The symptoms, too familiar to need comment, come and go under the stress of provoking circumstance and shifting varieties of therapeutic procedure. In these individuals the association experiment may start a clue for judicious inquiry. It may bring to light that a nervous woman has an extramural attachment, or that a trustee has turned speculator. But a sagacious physician soon finds out such things, and the association experiment will not help him much.

Jung believes so fully in the association test that he thinks it will give information against the will or desire of the subject. This is true to a certain extent. But I have always doubted the value of the

results when the subject was plainly unfriendly to the inquiry. Certain cases of hysteria illustrate this.

One lady intelligent in many ways, who had for years been treated by various forms of faith cures, became afflicted with peculiar paroxysmal spasms of the neck, abdomen, and legs. These proved to be phantoms of the sexual act, and dated from a time when a male hypnotist treated her by "laying on of hands" on the abdomen. This patient rebelled against all direct questioning; and in the experiment, to which she was opposed, she gave long association times to nearly all stimulus words; and often said she could "think of nothing." Her chief complex was erotic, but she cunningly defeated all experimental efforts to disclose it.

The same difficulty has arisen in cases of hysteria which were litigated. One plaintiff, suing for $50,000 damages, and perfectly able to converse intelligently, examined by the physician for the railway company, gave an average association time of 9.7 seconds, which, if not an effort to thwart the purpose of the investigation, was at least negativeness inspired by suspicion. But even in such cases the underlying principle exerts some influence. This plaintiff gave his longest association time—20 seconds—for the word *damages;* and in another somewhat similar case, in which the plaintiff had been the victim of a railway wreck, with an average time of 6 seconds, the longest reaction was for the word *collision.*

Similar uncertainties exist in criminal inquiries. Jung's original case was medicolegal, and the association experiment aided in the proof of stealing. Professor Münsterberg, in a popular article so ingeniously worded that the reader might infer that the discovery of this method of inquiry emanated from the psychological laboratory at Harvard, proclaimed the test as a final one for crime. It has won no such title. It may point to lines of inquiry which, if followed up, would furnish proof of guilt. But the possibility of the voluntary cloaking of complexes is too little understood as yet to make the experimental investigation of associations reliable in cases controlled by the strongest motives for deception. It seems further that reliance on this test might result in gross injustice. Immediately an individual is accused of crime the accusation itself creates a complex. And in the case of an innocent man this artificially created complex might lead to changes in association time as significant as though he were guilty.

I am unable to say how large a proportion of innocent persons accused of crime would react promptly to a list of 100 to 200 words. If an accused person could go through such a test without the arousal of complexes directly connected with the charge, it would be a strong presumption of innocence. This negative result, which seems to be the chief use of the test for the criminal investigator, is even more valuable in purely clinical cases. A person clinically suspected of insanity, is rarely swayed by the motives for deception

which actuate a prisoner. And an investigation with negative results in such a case would be strong proof that the suspected mental state was within normal limits. To such uses the test may be constantly put.

A young girl was the object of much solicitude on the part of her parents, her physician, and her teacher. She was impulsive; did not care to study; defied her parents; on two occasions she marched out of school, vowing she would never come back. And one day, without a word to any one, she cut off all her hair. They all thought that some hidden delusion or some insane impulse alone could explain such behavior. The reaction words in the association test showed plainly the "schon erlebtes" of Ziehen—for example, the childish type of mind in which the associations aroused have to do with personal experiences, not abstract ideas. There was no lengthening of association time, except for a few recent and unimportant emotional complexes. There were no traces of sexual traumas, paranoid associations, or psychic points of origin of morbid impulses. The result of the test was, therefore, negative. And therein lay its value. For the negative findings excluded the probability of the existence of motives of insane character. And these negative findings were further entirely in accord with outside information in the case. The child was headstrong and self-willed, and had missed judicious parental supervision. But these facts by themselves were not sufficiently evident to have made it possible to regard the patient's peculiarities as within the limit of normal. With the association test such a diagnosis became almost certain.

THE IMPORTANCE OF BLOOD CULTURES IN THE STUDY OF INFECTIONS OF OTITIC ORIGIN.[1]

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Although we made some studies of the bacteriology of the blood in cases of otitic infection some years ago, our interest in the subject was particularly aroused by a case in which the clinical diagnosis could not be definitely established, and in which the finding of streptococci in the blood led us to believe that it would be wise to explore the mastoid process, because the patient had a moderately

[1] Read at a meeting of the Association of American Physicians, Washington, D. C., May 11 and 12, 1909.

marked otitis media, and no other focus could be found from which the streptococcus might have entered the blood current. Not only was mastoid disease found, but there was also a sinus thrombosis present. A short time later a second case of the same type came under observation. We then decided to follow up the bacteriology of the blood more systematically in cases of acute and chronic ear disease, and encountered some other cases in which the bacteriological examinations were very valuable. In the last two years we have paid particular attention to this subject and will report in this paper a study of 163 blood cultures in 100 cases.[2] We have considered it advisable to present our results up to the present time for several reasons. In the first place, we believe that not sufficient attention has been paid by the internist to the border line work between otology and internal medicine. And it is the internist upon whom the responsibility often devolves of deciding whether an otological case should be operated upon or not. In the second place, the work illustrates very well how valuable a comparatively simple laboratory method may be in leading to important diagnostic and therapeutic conclusions. And thirdly, the studies, we believe, will be of interest because of the light they throw upon the question of the significance of certain forms of bacteriemia.

We shall not discuss the literature to any great extent, partly because we wish to include it in a later larger publication, and partly because much of it is based on bacteriological methods, the results of which cannot be accurately compared to the results obtained by our present methods. One of us (Libman) has given a brief summary of our earlier results on some former occasions.[3]

As part of our study we investigated the bacteriology of otitis media (particularly the acute forms) to ascertain the relative frequency of the organisms most commonly involved in the causation of the disease. We studied 277 cases with particular reference to the occurrence of streptococci, Streptococcus mucosus, and the pneumococcus. The organisms that are next most commonly found are the staphylococci, Bacillus pyocyaneus, and Bacillus proteus. Mixed infections were not uncommonly found.[4] We classified the streptococcus, Streptococcus mucosus, and the pneumococcus according to the classification that we have adopted as the result of studies made in our laboratory, particularly by Dr. Buerger[5] and later by Dr. Rosenthal together with one of us (Libman[6]).

[2] The actual number of cases is somewhat smaller than this, as some of the cases are listed twice, because they were first admitted to the hospital for otitis media and mastoid disease and then discharged and later returned with a suspected sinus thrombosis.

[3] Gruening, Libman, and Epstein, Transactions of American Otological Society, 1906; Libman, Archives of Otology, 1908, No. 1, p. 22.

[4] For fuller details see Libman, Archives of Otology, 1908, viii, No. 1.

[5] Jour. Exper. Med., August 25, 1905, vol. xiii.

[6] Trans. New York Path. Soc., February, 1908. A full report of studies will be published in the near future.

In the 277 cases which we studied we found streptococci present alone or with other organisms in 189 cases (81.46 per cent.), Streptococcus mucosus twenty times (10.34 per cent.), the pneumococcus nineteen times (8.2 per cent.). The earlier authors found the pneumococcus present more frequently than the streptococcus, but the more recent writers (Leutert, Funke, Suepfle, Wittmanck, Mark) found the streptococcus present more frequently than the pneumococcus. It is to be noted that while Streptococcus mucosus is morphologically a streptococcus, it is more closely allied from a biological standpoint to the pneumococcus.

Notwithstanding the fact that the pneumococcus has been found frequently by many authorities in the middle ear, and notwithstanding the fact that we have found the organism in a certain number of cases, there are hardly any records of sinus thrombosis being due to the pneumococcus, and we have not met with any such cases. The few cases that are to be found in the literature are not definitely proved, because the methods used for identifying the organisms as pneumococci are not stated. It has been shown in our laboratory by Drs. Buerger and Ryttenberg[7] that the pneumococcus can be so changed by its sojourn in the blood that it may be very difficult to differentiate it from the streptococcus. This fact must be taken into consideration, for it might occur that we might find an organism that looked like a streptoccocus in the sinus and it might prove to be a changed pneumococcus. We have investigated this point, and have not had any such experience in our sinus thrombosis studies. It is necessary to study a large number of cases so as to determine definitely how frequently the pneumococcus causes a sinus thrombosis and whether the pneumococcus really causes a less serious local form of otitic disease than the streptococcus.

The literature concerning blood cultures in cases of otitic infection is very meagre. Besides the work of Kobrak, which we shall discuss directly, there are practically no systematic studies of the subject. A review of what has been done along this line up to 1907 is given by Hasslauer.[8] The work of various investigators which is cited by Hasslauer cannot be used for comparison with our own work for the reason that so few casess were studied by each author, that the bacteriological methods varied very strikingly, and that hardly any of the authors made a comprehensive study of the primary focus, the blood in the general circulation, and the metastases. Some examined only the blood of the sinus. In general, one can

[7] Jour. Infect. Dis., 1907, vol. iv.

[8] Internationales Centralblatt f. Ohrenheilkunde, 1907, v, 1. See also Leutert, Archiv f. Ohrenheilkunde, lxxiv, 23. He gives references to a few further cases in which bacteriological examinations were made either of the sinus blood or of the blood of a peripheral vein. A case of general infection is mentioned briefly by Lenhartz (Septische Erkrankungen, 1903, p. 335), in which there was a remarkable decrease in the number of colonies of streptococci in the blood in a case of otitic infection with recovery. No data are given as to whether the patient had a sinus thrombosis or not, or whether any operations were performed.

draw the conclusion that the streptococcus was found in most of the cases.

Kobrak[9] found streptococci predominating in the primary focus He then studied 20 cases of acute otitis media, which were accompanied by fever in the first few days, believing that he would find that a bacteriemia was responsible for the fever. In all these cases the blood proved to be free from bacteria. He later took blood cultures only in cases of marked severity with fever of long duration and he states that he found positive results only if the fever was pyemic, that is in so-called "septic cases." In 11 cases in which a positive blood culture was obtained, he found streptococci seven times, Streptococcus mucosus twice, the pneumococcus once, and the staphylococcus once. Of the 7 streptococcic cases, 4 died, all, as he states, "markedly septic." He states that in one case there was only a peribulbar abscess, and in another there was a direct infection from the ear. In the 2 mucosus cases the organism was also found in the cerebrospinal fluid.[10] His total studies of streptococcic cases comprise 28, with general infection in 7. In 17 pneumococcic cases he found the pneumococcus in the blood once only.[11] He remarks that in cases of otogenic "sepsis" the decrease in the number of colonies in the blood and in their hemolytic power is of no significance, but rapid increase in the hemolytic power or in the number of colonies renders the prognosis very bad. The author does not give details as to the clinical course of these cases, nor the details of the post-mortem reports in the fatal cases. It can not be determined in how many cases it was possible that the patient had a sinus thrombosis from which he recovered without operation, nor can it be determined whether autopsies were performed in the fatal cases, and if so, how carefully the veins were examined.

Since we have paid closer attention to this subject we have made blood cultures in 50 cases of mastoid disease with recent or old otitis media, and in 10 cases of uncomplicated otitis media. Some of the cases of mastoid disease were accompanied by extradural abscesses. About one-half of the cases had at some time or other a temperature of 102.5° F. or over, some had a lower temperature, and some were practically afebrile. In a few of the cases the otitis media was bilateral. In our older series of cases we had positive results in two fatal cases of otitis media, but in both instances the blood cultures were taken but a short time before the fatal termination. In neither case is there a record of an accurate examination of the sinuses and the jugular bulbs.

[9] Allg. med. Centralzeitung, 1907, lxxvi, 299. See also Verh. der Deutsch. Otolog. Gesellsch., 1907, xv, 93.

[10] As will be seen later, we have also had positive results in otitic meningitis due to Streptococcus mucosus and to the pneumococcus.

[11] He does not state how the pneumococcus was identified.

Our method, in brief, was to withdraw from 10 to 25 c.c. of blood from one of the arm veins (if necessary, from some other vein), and to incubate the material in agar, glucose agar, serum agar, glucose serum agar, and in bouillon and glucose bouillon with and without serum. If a large amount of blood was obtained, nearly all of these media were used. When a small amount was used, preference was given to the media containing glucose and serum. We often tested the value of using the blood in smaller and larger amounts in the various media. No differences were found. The plates and flasks were incubated for five days, subinoculations being made from the flasks (after shaking) in glucose bouillon and on serum glucose agar. In children we have often been compelled to use a smaller amount of blood, particularly in infants. We might state here that our studies in infants and young children are not yet extensive enough to warrant deductions.

Kobrak is not the only author who claims to have found a general infection in cases of otitis media without involvement of the sinuses or meninges. There are other scattered reports of such cases. It is essential to study a very large series of cases of uncomplicated otitis media and mastoiditis to determine the real frequency of such an occurrence.

Our positive results in otitis cases have been found only in those complicated by meningitis or sinus thrombosis (of course we include here thrombosis of the jugular bulb). In the meningitis cases we have found the pneumococcus and Streptococcus mucosus in the blood. In some of these cases a complete postmortem examination was not permitted, and we cannot state whether an infection of the veins was also present or not.

Before the cultures were made exclusively by one of us (Celler), we had a series of 14 cases in which the blood cultures were taken in different cases by different men, and in which repeated cultures were not made. Of these 14 cases, bacteria were found in 9, giving a precentage of 64. The later series comprises 16 cases, of which 14 gave positive results, giving a percentage of 87.5. In one negative case the clot obtained at the time of operation was found to be sterile; it was inoculated on media after being thoroughly ground up. In the other case we did not have the opportunity of seeing the clot, but the surgeon informs us that it was parietal and that it looked like an organizing non-purulent thrombus. It is possible that the high percentage of positive results is due to the fact that repeated cultures were made and that in a number of cases the cultures were made earlier than we were accustomed to make them a few years ago. If we reckon together both sets of cases, we have a total of 30 cases with 23 positive blood cultures (77 per cent.).

In the old series of cases streptococci were found in all of the 9 positive cases (during part of this time an accurate identifica-

tion of Streptococcus mucosus was not yet being made in the laboratory). In our second series streptococci were found eleven times, Streptococcus mucosus twice, and Bacillus proteus once. It will be noted, as stated before, that we have not found the pneumococcus in any of the cases. In our subsequent discussion we shall base our remarks only upon the cases in which the streptococcus and Streptococcus mucosus were found, classifying them for clinical purposes together.

In one positive case Streptococcus mucosus had been found in the primary otitis media and in the pus from the mastoid, but an ordinary streptococcus was isolated from the blood. The patient had been discharged from the hospital with an open wound, in good health, and returned later with a sinus thrombosis. The wound could have easily been secondarily infected by a streptococcus during the weeks that elapsed between the time of the mastoid operation and the time of development of the sinus affection. In cases in which there is a mixed infection of the middle ear, only one of the organisms may be found in the pus in the mastoid bone. In the case of general infection by Bacillus proteus, which we have cited above, the cultures from the middle ear also showed a large number of streptococci.

According to our recent experience, it would appear that nearly all cases of sinus thrombosis are accompanied by a bacteriemia at some time or other. We are inclined to believe, from a general survey of all our records,[12] that there may be early no bacteriemia, that the bacteria may then be found perhaps in increasing number, and that it is possible for the bacteria to decrease in number and even to disappear before there has been any operative interference.

It is of interest to attempt to explain the occurrence of the negative results in some of the cases. Different explanations probably hold for different cases. In some cases (probably rarely) the clot is sterile and it is easy to explain the absence of bacteria in the blood. In some cases the blood culture may have been taken before the bacteriemia had been established or after the bacteria had disappeared from the blood. Bacteria may be present in the blood in too small number to be found in the amount of blood used in making the cultures. This would not necessarily mean that there had not been many bacteria discharged into the jugular vein, because there is a possibility that large numbers of the bacteria may be rapidly killed off, in which event few or none might be found in the blood obtained from one of the peripheral veins.[13]

It is also possible that in certain cases there is below the infected clot an obturating, non-infected clot which prevents the bacteria

[12] It is difficult to draw conclusions from any one case, because cultures cannot be taken frequently enough to make thorough observations.

[13] See Leutert, infra.

from entering the circulation. One can also imag ne the possibility of there being an infected clot which completely closes the vessel. Another possible explanation is that, in the course of the infection the blood may acquire a higher bactericidal power.

In some instances a bacteriemia is cut short by tying the jugular vein. In such cases metastases may develop even though the blood is free from bacteria. They may develop from bacteria or bits of clot deposited in various parts of the body before the vein has been ligated. All such foci need not appear at once. We must also remember that at the time of operation, particularly if the sinus itself is exposed before the jugular vein is tied, and there is a thrombosis present, bits of infected clot may be scattered. In this way also metastatic foci could develop without a persisting bacteriemia.

In some cases in which the jugular vein has not been tied, metastatic abscesses may be found in the lungs and there may be no bacteria in the circulation. In these cases, which are generally older ones, we are often dealing with a softened clot from which pieces are broken off which contain bacteria which set up secondary foci. The probable explanation is that free bacteria are promptly killed off, but that those carried in pieces of thrombi are protected during their passage through the blood from the bactericidal power of the latter. In our experience, the metastatic foci in cases of so-called "pyemia" do not cause a bacteriemia.

Our studies show that cases in which streptococci are found in the blood after the disease of the mastoid is properly operated upon, and in which clinical symptoms persist and no other cause can be found for a streptococcemia, are cases of sinus thrombosis. It is very important to consider carefully the possibility of other causes of streptococcemia (or other bacteriemia) in such cases. In our investigations the cases of otitic disease which even before operation showed a streptococcemia, and in which other causes for a streptococcemia could be excluded, showed sinus thrombosis at operation or at autopsy. We would not be willing to state absolutely, however, that in all the cases in the latter group a sinus thrombosis would be found, because our studies in cases of acute otitis media and mastoiditis uncomplicated by sinus thrombosis are not yet extensive enough. But if the middle ear has been properly drained and the mastoid has been operated upon and there is no meningitis present and no other cause found to explain the persisting bacteriemia and persistent clinical symptoms, we come, practically by exclusion, to the assumption that a lesion is present in the veins which causes the bacteriemia.

It is necessary, in studying such cases, to take a number of points into consideration. There is always a possibility that a patient is suffering from a general infection in the course of which he develops otitis media or mastoid disease. This is particularly liable to occur in cases of general pneumococcic or streptococcic infection, cases of

pneumonia,[14] and cases of typhoid fever. In cases of typhoid fever it is essential to know whether or not the otitis media developed after the patient had already had fever. The presence of typhoid bacilli in the blood, if one were in doubt as to whether marked symptoms were due to an otitis media by itself or to a complicating typhoid, would make us feel that we could ascribe the fever to the typhoid infection alone. The rest of the diagnosis would have to be based on clinical signs and on the development, possibly, of a streptococcemia, although it is to be remembered that rarely a patient with typhoid fever suffers from mixed infection with streptococci. In some of these cases it might be very difficult to come to a conclusion as to the exact condition in the mastoid and surrounding parts.

It is also important to note the possibility of a bacteriemia following operative interference upon the middle ear or the mastoid process. In all of our cases in which we found streptococci in the blood after the mastoid had been operated upon, a sinus thrombosis was found. But from our experience with postoperative bacteriemia after operations in other parts of the body, we believe that one should be very careful in judging of positive blood cultures if the blood cultures are taken directly after there has been operative interference.

It has often been pointed out that difficulties might arise because of the possibility of a developing erysipelas or the presence of an angina. It has been feared that one would have difficulty in interpreting a streptococcemia in a case of otitic disease if either of these conditions were present. As a matter of fact, in our experience we have very rarely found streptococci in the blood in erysipelas, and then it has only been in fatal cases. This experience seems to be shared by other investigators of the blood in this disease.

The question of a possible confusion because of the presence of an acute angina is a very important one. Streptococcemia in such cases is very infrequent. In our experience we have fortunately had no trouble from this source.

Leutert[15] and, later, his assistant, Nuerenberg,[16] have suggested a method for attempting to overcome the difficulty involved under the conditions mentioned above. Leutert has suggested taking blood cultures from the sinus and from the jugular vein and an arm vein. He believed that if more streptococci were found in the blood of the sinus than in the blood of the jugular vein or an arm vein, or if organisms were found in the blood of the sinus and none in the blood of the peripheral vein, one could conclude that the bacteria were gaining entrance to the circulation from the sinus, and that the bacteria were not entering the blood from the coincidental angina

[14] If in a case of otitis media due to streptococci, pneumococci should be found in the blood, one would have to think of a developing lobar pneumonia.

[15] Archiv f. Ohren., lxxiv, 18. [16] Münch. med. Woch., No. 51, p. 5227.

or erysipelas. They describe several cases in which they found this method valuable, but they admit what at once must strike any one as a serious objection. The results cannot always be depended upon, because the sinus is aspirated through an infected area. In one case we aspirated the sinus because we could not obtain blood from one of the peripheral veins. The blood from the sinus was sterile; a clot found at operation was also sterile.

In our cases the number of bacteria found in the blood in cases of sinus thrombosis accompanied by bacteriemia has varied from less than one to the cubic centimeter up to 245 to the cubic centimeter. In all of the cases, except those that died within a few days after admission, we attempted to ascertain how rapidly the bacteria disappeared from the blood after operative interference. In all except three cases, which we will describe later, the bacteria disappeared rather promptly. As a rule, the bacteria did not disappear until the jugular vein was tied. There were two cases, however, in which the bacteriemia disappeared after a clot was removed from the lateral sinus and the jugular vein was not tied.

In our early studies we took the secondary cultures forty-eight to seventy-two hours after operation, and we found that the bacteria had disappeared in all the cases except in the three soon to be described. In some of the later cases we took the blood cultures twenty-four hours after ligation of the jugular vein, and these cultures also gave a negative result. It is very remarkable to see as many as 245 streptococci to the cubic centimeter of blood disappear within twenty-four to forty-eight hours after ligation of the jugular vein. In one case there were seven colonies of streptococci to the cubic centimeter of blood; within eight hours after ligation of the jugular vein the blood culture was negative and remianed so.

The three cases in which bacteria did not disappear promptly after ligation of the jugular vein were of particular interest. In one the streptococcus persisted in the blood after the clot had been removed from the lateral sinus and the jugular vein had been tied.[17] The bulb of the jugular vein was then exposed, a clot removed, and then the bulb packed; the bacteriemia (there were two colonies to the cubic centimeter of blood) then promptly disappeared in less than four hours. In this case we believe the continuance of the bacteriemia was probably due to infection of the general system by way of the inferior petrosal sinus.[18]

In another case the bacteriemia disappeared after ligation of the jugular vein, but a couple of metastatic deposits developed.

[17] In all these cases in which the jugular vein was tied a section of the vein was resected. The operation on the sinus usually consisted of removing as much clot as possible, and packing.

[18] We shall attempt to continue the study of the rapidity of the disappearance of organisms from the blood of these cases by making cultures at still shorter intervals after operation than we have heretofore done. We shall report any results that we may obtain at a later time.

The patient also had a right-sided mastoiditis, which was operated upon. Later, streptococci were again found in the blood, the patient developed more metastases, and finally recovered. Although at the time we did not think of the possibility, we now believe that it is probable that in this case there was also a thrombosis on the right side, from which the patient recovered without operation. We know that some cases of sinus thrombosis with or without metastases have recovered without operation. The same holds true of infected veins in other parts of the body.

In a third case in which the bacteria persisted even after the local focus had been thoroughly dealt with (and this was confirmed at autopsy), the persistence of the bacteriemia was due to the development of an acute (ulcerative) endocarditis.

The studies on the disapperance of the bacteria in these cases have almost the value of experiments. They show that the bacteriemia is due to discharge from the local focus, and that the bacteria remain in the blood after the local focus has been thoroughly dealt with (when that is possible) only if multiplication of bacteria occurs in the blood or if an acute endocarditis is established. Both these conditions have been very unusual in our experience.[19]

What then, according to our experience, is the value of blood culture studies in cases of otitic infection? We will discuss first the significance of positive results and then briefly the value of negative results:

1. Significance of Positive Results. (*A*) A positive blood culture is valuable when there is doubt as to the existence of a sinus thrombosis after a patient has been operated upon for mastoid disease. In many cases the diagnosis is clear enough clinically, but in a certain number of cases in which the mastoid disease had been thoroughly dealt with, and in which there were clinical symptoms still present, and in which the otologist was not sure that there was still further local disease, the finding of streptococci in the blood has given the indication to explore the sinus, and in all the cases of this type a sinus thrombosis was found. As we have stated before, it is essential to exclude all other causes of streptococcemia.

A case worthy of citation here is that of a man, aged thirty-three years, who developed pain in the left ear, following an attack of grippe, four weeks before admission to the hospital. There was increasing tenderness over the mastoid process and slight fever, but at no time any ear discharge. The drum membrane was slightly reddened. It was also noted that there were very tender and large lymph nodes behind the angle of the jaw. During the first three days of the

[19] In the case of general infection by Bacillus proteus, which is mentioned earlier in the paper, the bacilli also persisted until death, but in this case the local focus could not be thoroughly dealt with, because the thrombosis had extended into both petrosal sinuses on the same side, both cavernous sinuses, and into the lateral sinus of the opposite side.

patient's stay in the hospital his temperature ranged between 100° and 102° F., the pulse rate varying from 70 to 84. On April 20 the temperature rose to 103° and he was operated upon. A chronic mastoiditis was found. After the operation the temperature dropped, so that on April 24 and 25 it was practically normal. On April 26 there was a slight chill and rise of temperature to 102° F. During the following four days the temperature was about 101° F., once reaching 103°. On April 29 the patient was allowed to be out of bed. The pulse rate was 72 to 80. The leukocyte count was 21,200, the differential count showing 80 per cent. of polynuclears. In the early afternoon of May 2 a blood culture was made, the patient being up out of bed in a chair. On the evening of the same day the patient had a chill; his temperature rose to 104.6°. The following day, when the temperature was down to 100°, we reported that there were 210 colonies of Streptococcus mucosus to the cubic centimeter of blood. As there was no other cause for such an infection, it was decided to operate again, in the expectation of finding a sinus thrombosis. The operation was performed the same afternoon. A thrombus was found in the lateral sinus. The jugular vein was ligated in two places, the intervening part being removed. On the following day, May 4, the blood culture was found to be negative. The temperature was normal by May 6. In this case the clinical symptoms which suggested making the blood culture were the moderate irregular fever, the increase in the leukocyte count, postmastoid tenderness, and a rather sickish look of the patient.

Another very striking case was that of a girl (M. L.[20]), aged twenty-two years, who was admitted to the hospital on January 28, 1908. The patient at first suffered from la grippe, followed by spontaneous perforation of the left drum membrane with purulent discharge. Four days before admission the right drum membrane was incised; this was followed by discharge. The temperature at the time ranged between 99° and 100°. On the day before admission the temperature rose to 103°, the patient complaining of marked deafness. There was pronounced nystagmus, some nausea and vomiting, and considerable frontal headache. On January 28 and 29 the temperature was between 101° and 102°. On January 30 the temperature was 103°; pulse, 90 to 104. On the same day operation was performed on the left mastoid. Pus was found in the cells of the tip of the mastoid, in the antrum, and over the sinus; the sinus itself appeared normal. On January 31 the temperature dropped to 101°. On Februray 1 it rose to 104°.

On the same day operation was performed for acute mastoiditis on the right side. There was found moderate necrosis of the cortex and of the tip. Some pus was found in the antrum. On February 2 the temperature was 103°. On February 3 the temperature rose

[20] This and the previous case occurred in the private practice of Dr. Seymour Oppenheimer.

to 104.4°. A blood culture was made, and three and one-half colonies of streptococci to the cubic centimeter of blood were found. On the following day, when the report was handed in, the temperature was 100.8°. On February 5 another blood culture was taken at a time when the temperature was 103°, and we found fifteen colonies of streptococci to the cubic centimeter of blood. We advised exploratory operation for sinus thrombosis.

But during the next week the patient appeared to be doing so well, the temperature not rising above 103°, as a rule, that the otologist did not consider that he was warranted in operating any farther on the patient for the time being. On February 13, at a time when the patient had a temperature of 103.4°, another blood culture was taken, and there were found to be present sixty colonies of streptococci to the cubic centimeter of blood. On the following day, when the report was handed in, the temperature was only 101°, and operative interference was again deferred. On February 15 the temperature rose to 103°, and on the 16th it dropped almost to 99°. A blood culture was taken on that day at 4 P.M., the temperature being 99.6°, and again there were found to be sixty colonies of streptococci to the cubic centimeter of blood. For the next two days the temperature did not rise above 100.4°, and the patient seemed to be doing remarkably well. On the morning of February 19 the temperature was 99°. At noon the temperature was 100°; in the afternoon the temperature began to rise.

On examination of the patient there was found to be tenderness in the region of the jugular bulb, and there were some enlarged tender lymph nodes along the course of the jugular vein. A blood culture taken at this time, 3.30 P.M., showed two colonies of streptococci to the cubic centimeter of blood. At 4 P.M., when the temperature was about 102.5°, the patient was operated upon. The jugular vein was exposed in the neck and part of it resected. About one-half inch above the entrance of the facial vein the wall of the jugular vein was white in appearance, very firm, and the vein appeared to be flattened. There was marked inflammation of the lymph nodes about the vein. A non-suppurative clot was found in the vein which closed the vessel as far down as the point of ligation and extended slightly on the wall of the vein for a short distance below the upper ligature. The temperature the same night rose to 103°, but dropped the next day to 99°, and never rose above 99.8° after that, the patient making a complete recovery. A blood culture made on February 22, three days after ligation of the jugular vein, proved to be negative.

This case is one of the most remarkable in the entire series which we have studied. The suspicion of a sinus thrombosis was aroused by the blood culture results over two weeks before it was clinically considered proper to operate for supposed sinus thrombosis. It is interesting to note that the streptococci gradually increased in

number, and then decreased even before the jugular vein was tied. If the jugular vein had not been tied at the time it was, we believe it is possible that the blood cultures might have become negative before the ligation was performed. There are a number of other points of interest about this case, especially in regard to the leukocyte counts, a discussion of which we must postpone for another time.

(*B*) In certain cases, after the sinus has been explored and a clot has been removed and the jugular vein has not been ligated, the persistence of streptococci in the blood has given the indication to tie the jugular vein, and, as we have previously stated, in almost all of the cases the bacteria then promptly disappeared from the blood. A case showing in a striking manner the value of such a finding will be given in the case (Levin) to be described under the next heading.

It should be noted here that while the bacteria usually promptly disappeared after ligation of the jugular vein, the clinical symptoms (particularly the fever) do not always as promptly abate. In some cases the patient will still have fever, due possibly to local conditions in the wounds, or due to metastases previously developed or being developed, or due to some other intracerebral complication or to some intercurrent disease.

We have already pointed out that in one case the bacteria did not disappear even after the jugular vein was ligated, but did disappear after the jugular vein was exposed, a clot removed, and the vessel packed. This case (Klein) will be described briefly under the next heading.

(*C*) The most valuable field for the blood culture studies has been in the border line cases, in which it would have been very difficult to come to a definite conclusion without the use of the cultures. The first case of this type, a male, aged seventeen years, was admitted to the hospital in the service of Dr. Rudisch on January 3, 1904. For the first three days after admission he had an almost constant temperature of 103° to 105°. For the following three days the temperature ranged between 100.5° and 103°, the pulse rate varying from 92 to 100. The history given was that the boy had suffered from headache and malaise for eight days. He had then become feverish and chilly and remained in bed. He had then developed abdominal pain for one day. Three or four days before admission he had severe shaking chills followed by sweating. The boy was sent into the hospital for supposed typhoid fever. On examination by one of us (Libman) on the day of admission the boy did not give the impression of suffering from typhoid fever. There were no rose spots present. There was no enlargement of the spleen. On thoroughly examining him it was found that he had a moderately marked otitis media on the left side.

The otologist was then called in to see the patient; he punctured the left drum, and a little seropus was evacuated. The leukocytes

numbered 17,600. There was some tenderness over the tip of the mastoid. The otologist did not believe that the otitis media by itself could explain the clinical picture. The Widal examination proved to be negative. In was then suggested that a blood culture be made so as to determine whether any organisms were present in the blood. It was thought that if typhoid bacilli were present in the blood the case would be regarded rather as one of typhoid fever with a complicating otitis media, but if streptococci were found in the blood it would be proper to advise operation upon the mastoid, because there was no other demonstrable focus found from which the organisms might be entering the blood current. At this time we believed that more extensive trouble might be found than there appeared to be according to the local findings. On January 4 the blood culture was taken, and on January 5 it was reported that streptococci were in the blood. The mastoid region was explored on the same day by Dr. Gruening. Not only was mastoiditis found, but there was a clot in the lateral sinus which extended down as far as the exposure would allow. A perisinuous abscess was also found. The patient's condition became so poor that the jugular vein could not be tied off. The temperature dropped next day to 100°, but during the next two days rose again to 102°. A blood culture was again taken on January 6, and streptococci were again found. At that time we did not understand the significance of the persisting bacteriemia, and did not urge further operation, but on January 8 Dr. Gruening, because of the persistence of the clinical symptoms, considered it advisable to tie the jugular vein. A blood culture taken on January 12 proved to be negative, as was also one taken on January 19. The patient developed a few metastatic abscesses which we believed were probably to be explained by the dissemination of bits of clot before the jugular vein was tied.

After the diagnosis in this case had been cleared up a history was obtained by careful cross-questioning of the patient and his relatives, which differed from that obtained on the admission of the patient to the hospital. Eight days before admission the patient had developed pain in the left ear. This pain lasted for three days. It was slight in the morning and moderately severe in the evening. The pain then disappeared, and the patient suffered from headache, which was first located in the left side of the head and then was frontal in character. He then developed abdominal pain.

We have previously in this paper drawn attention to the difficulties that might arise at times in the differential diagnosis between sinus thrombosis and typhoid fever. The complete question of differentiation, including the question of the clinical phonemena, we hope to take up on another occasion.

Shortly after seeing the case which we have just described, on January 21, 1904, a female patient, aged twenty-seven years, was admitted. The history given was that she was sick for fifteen days

suffering from severe occipital headache with stiffness and tenderness of the neck. She had had chills and fever coming on every second day and followed by profuse sweats. On examination of the patient perforations were found in both drum membranes. On the left side there was fairly marked tenderness behind the mastoid process and along the occipital ridge. There was no tenderness on the right side. There was no rigidity of the neck. On January 21 the patient had a chill and temperature of 105°. On January 22 the temperature was down to 102.4°; the leukocyte count was 13,000. On January 23 there was a chill in the early morning and a rise of temperature to 105°; the leukocyte count was 10,000. The spleen was palpable one finger below the free border; it was very firm. The otologist did not believe that in this case there was sufficient evidence of local trouble to warrant operation. The clinician in charge of the case was inclined to believe that the patient was suffering from malaria, but plasmodia could not be found.

We suggested that, before waiting for the result of treatment by quinine, it would be advisable to take a culture, which was accordingly done on January 23. On January 24 it was reported that there were streptococci in the blood. It was considered warrantable to explore the mastoid process, as there was a certain amount of suspicion from the local examination that there was more trouble there than the old otitis media, and because there was no other focus found from which the streptococci were gaining access to the blood current. The cortex of the mastoid was found thick and hard. In the antrum there was granulation tissue. The lateral sinus was found to contain a clot, part of which was decolorized. The clot extended around to the torcular. On January 25 the temperature was 98.8.° On January 26 the temperature was 102.8°. The margins of the wound were found to be necrotic. On the same day a blood culture was taken, which was found to be negative. The patient's temperature was normal by January 31, and she was discharged practically well on February 26. No metastases developed in this case.

A third illustrative case we will cite briefly: This patient was admitted to the hospital on February 28, 1909. He was a male, aged nineteen years, who had had pain in the left ear ten days before admission to the hospital; there was also profuse discharge. The following day the patient developed the same symptoms on the right side. At the time of admission to the hospital there was no discharge from the left ear, but the right ear continued to discharge pus and there was tenderness at the tip of the mastoid process. The patient stated that he had had several chills. On examination it was found that the drum membrane was reddened and there was a medium-sized perforation. There was tenderness over the tip of the mastoid process and slight tenderness in the region of

the jugular bulb.[21] The temperature was irregular from February 28 to March 1, reaching 103° and 104°, and on March 2 only reaching 101.4°. It was not believed by the otologist that there was sufficient evidence of local trouble to warrant operation. The examination of the patient otherwise was negative, and a blood culture taken on March 2 showed streptococci, there being seven colonies of streptococci to each cubic centimeter of blood. The patient was operated upon on March 3. Just before the operation streptococci were again found in the blood, there being nine colonies to the cubic centimeter. At the operation the mastoid cells were found only slightly diseased. The wall of the sinus was thickened. A large amount of white thrombus was scraped out of the sinus. Free bleeding was established from the cerebral end of the sinus, but only a moderate amount of bleeding occurred from below. The patient was in too poor condition to tie the jugular vein. A blood culture taken a few hours after operation showed 165 colonies of streptococci to the cubic centimeter of blood (in this case the postoperative increase can be fairly ascribed to the operative interference). The following morning the blood culture showed less than one colony of the streptococcus to the cubic centimeter of blood. On March 5 it was decided, because of the persistence of streptococci in the blood and the continuance of clinical symptoms, to tie the jugular vein, which was accordingly done. A drain was passed down into the bulb of the jugular vein from above. The following day there were still streptococci in the blood, 200 colonies to the cubic centimeter, and streptococci persisted in the blood until the patient died. At the autopsy no further trouble was found in the sinus or in the jugular vein, but an ulcerative endocarditis was present.

In some cases it is very difficult to come to a conclusion unless one judges carefully all the facts. We have had two cases in which the conditions were particularly complicated. Unfortunately, both patients arrived at the hospital in very bad condition, and died within a few days.

The first case was a female, aged seventeen years. She gave a history of fever and headache lasting for two weeks, being accompanied by severe dry cough. On the afternoon of admission the right ear began to discharge. On examination there was found profuse purulent discharge from the right ear. There was tenderness over the tip of the mastoid and some tenderness along the jugular vein. The examination of the fundi showed some dilatation of the veins on both sides, more marked on the right side. The leukocyte count was 14,200; polynuclears, 76 per cent. The temperature on admission was 105°. On examining the lungs, crepitant

[21] In a subsequent communication by one of us (Libman), dealing with a method for testing patients for their sensitiveness to pain, it will be shown that much stress cannot be laid on tenderness in the region of the jugular bulb unless the patient is normally hyposensitive.

rales were found at both bases. At the left base there was dulness, and on auscultation numerous rales and a rather large area of bronchial breathing. In this case the ear surgeon was not ready to operate because of the presence of the pulmonary phenomena, particularly on the left side. It was decided to wait before exploring the mastoid process until the blood culture was made. If pneumococci were found, it was decided that they might be considered an accompaniment of the lung condition. But if streptococci were found, it was considered that it would be justifiable to explore the mastoid region, as it was possible that they were gaining their entrance from that point, and the lung lesion might be secondary. The blood culture was taken on the day of admission at 7.30 P.M., and the following morning streptococci were found (one colony to the cubic centimeter). The mastoid process on the right side was explored. Granulations and pus were found. Pus was found in the lateral sinus. The jugular vain was then ligated. The patient died the following morning. A postmortem examination was not permitted.

The other case was that of a man,[22] who was admitted to the hospital January 30, 1907. The patient had suffered for a number of days from a severe inflammation of the alveolar border of the right lower jaw, with an enlargement of the submaxillary lymph nodes. A few days later he developed pain in the right ear. A puncture was made, but no pus was found. A few days later there was a discharge of pus. The patient had high temperatures for several days before admission. There was tenderness and swelling of the muscles of the right calf, and the skin over them was reddened. There was but little mastoid tenderness. The patient was evidently severely sick and it appeared that the trouble in the right calf was a developing metastatic abscess. There was also some pain and redness of the first joint of the left thumb.

The question arose as to whether the metastatic abscess was due to infection of the sinus or to the infection of the lower jaw. We argued that in this case the presence of streptococci in the blood would suggest an exploration of the sinus, because in our experience the infections of the lower jaw, particularly those at the alveolar border, do not give a bacteriemia, and because one does not generally find secondary foci in such cases. Further, we knew that infections of the sinus were apt to be accompanied by a bacteriemia and that in some cases of otitic infection there was a tendency for metastatic processes to be established in the muscles.

The otologist decided in this case not to take any chances by waiting because the patient was so severely sick, and the patient was operated upon on the day of admission, a blood culture being taken just before the operation. At the operation a purulent clot was found in the lateral sinus and a clot in the upper part of the

[22] This case was studied through the courtesy of Dr. Carl Kaller.

jugular vein. The jugular vein was resected. Streptococci were found in the blood (two and one-half colonies to the cubic centimeter). Streptococci were again found in the blood a few days later (three colonies to the cubic centimeter). The patient died a few days later; postmortem examination was not permitted.

These cases show clearly in what manner we have attempted to utilize the positive results in helping to diagnosticate doubtful cases. As we have already pointed out, it would seem from our studies that the streptococci remain in the blood in the cases of sinus thrombosis either because there is still trouble present in the veins or because endocarditis has been established. The establishment of endocarditis in these cases occurs, according to our experience, very infrequently. Multiplication of streptococci as a possible cause of persistence of streptococci in the blood, after proper attention has been paid to the local focus, must also be reckoned with as a cause of persistent bacteriemia. We have not found any instance of this occurrence in the series of cases upon which our report is based.

2. Significance of Negative Blood Cultures. (*A*) We have shown that negative results can be obtained, even though not frequently, in cases in which a sinus thrombosis is present. The absence of bacteria in a doubtful case would make one hesitate in exploring for a thrombus until the possibility of all intercurrent diseases had been excluded, or until the symptoms had become so severe as to justify an exploratory procedure.

(*B*) If the blood culture should be negative and the symptoms should persist in a given case, whether there is a sinus thrombosis or not, acute endocarditis can be excluded. In such cases it is advisable to take two blood cultures. In our experience in cases of acute endocarditis due to ordinary streptococci (and staphylococci) bacteria are always found in the blood if two cultures are made.

(*C*) As we have already stated several times, if there has been a sinus thrombosis and bacteria have been present in the blood, and the jugular vain has been tied, a negative culture is of value in showing that the general invasion has been stopped.

(*D*) Occasionally a negative blood culture has been of value in cases with a clinical picture of rheumatism. It is very valuable in such cases to know that we are not dealing with an arthritis due to a general invasion by the ordinary bacteria.

The data which we have given are sufficient to show the great value of the investigation by means of blood cultures in cases of otitic infection. It is important to know that in no line of work are routine rules more disadvantageous in attempting to draw conclusions. Each case must be made the subject of a careful clinical and bacteriological study. We hope that our work will stimulate others, who are in possession of larger material, to investigate their cases according to the methods which we have suggested.

Most of the cases which form the basis of this paper occurred in the service of Dr. E. Gruening, to whose kind coöperation we owe the possibility of having made our studies. The recent cases were investigated through the kindness of Dr. F. Whiting. We are also much indebted to Dr. S. Oppenheimer for the privilege of making studies in a number of his cases and for the use of the clinical histories.

ADDENDUM.—Since reading this paper we have made cultures in 17 additional cases of otitis media and mastoid disease. In only 1 case were streptococci found in the blood, and in this case at operation a purulent thrombus was found in the lateral sinus. The streptococci disappeared from the blood within seven hours after operation. We have therefore now had 75 cases of otitis media or mastoid disease without sinus thrombosis or meningitis, and in all these cases the blood has been sterile.

Drs. A. Duel and J. Wright,[23] of New York, reported a series of blood cultures made in cases of otitic disease, in which they obtained positive results in cases of uncomplicated otitis media and mastoid disease. The method used in the study of these cases was somewhat different from our own, inasmuch as the authors in most of their cases made a practice of incubating 10 c.c. of blood in flasks containing 150 c.c. of bouillon or glucose bouillon; after two to three days 15 to 30 c.c. of the contents of the flask was centrifuged and cultures were made on solid media from the sediment. Before reading the paper, Drs. Duel and Wright were kind enough to inform us of the method which they were using in the study of their cases, and since that time we have employed it in 11 cases of otitis media and mastoid disease, comparing it with our own method. The results were identical, all the cultures being negative. Besides this we made a study of 65 cases of local infections in different parts of the body of a type which, according to our experience, is unaccompanied by a bacteriemia, using both the strong concentration of the blood, as suggested by Dr. Wright, and also employing our own method. In all these cases the blood cultures were negative.

[23] At a meeting of the American Otological Society held in Boston, June 1, 1909.

TUBERCULIN-TREATED GUINEA-PIGS IN THE RECOGNITION OF TUBERCULOSIS.

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The experiments upon which this paper is based were undertaken in order to determine to what extent the tuberculin reaction in guinea-pigs might be of value in the diagnosis of human tuberculosis. The problem which presented itself was to reduce the length of time required for the determination of tuberculosis in guinea-pigs that had been inoculated with material containing tubercle bacilli.

The method now most commonly used is to introduce the suspected material either into the peritoneal cavity or the subcutaneous tissue of the abdomen of a guinea-pig, and after four to eight weeks examine the animal for tuberculosis. Block[1] modified this procedure by introducing the material in the region of an inguinal gland and then, by squeezing the gland, so lower its resistance that he could recover bacilli in nine to eleven days. F. Klemperer,[2] by a similar method, except that he did not squeeze the lymph gland, found tubercle bacilli in stained sections of it in ten to fourteen days. He found, in using Block's method that the pigs often died of mixed infection. Nattan-Larrier found that if virulent tubercle bacilli were injected into the base of the mammary gland of a lactating guinea-pig the bacilli could be found in the milk in from five to ten days. An indirect test has been described by Mérieux,[3] who obtained the tuberculin reaction in tuberculous guinea-pigs after the injection of serum from a tuberculous patient.

Anderson,[4] while determining the presence of tubercle bacilli in milk, found if he injected 2 c.c. of crude tuberculin into guinea-pigs two months after they had been inoculated with tubercle bacilli, that death almost invariably followed in six to eighteen hours. Guinea-pigs with slight lesions in two or three instances did not die, but became sick. All of the animals died when the lesions had caseated. As much as 7 c.c. given to a healthy guinea-pig caused only temporary discomfort. Anderson believes this test of distinct service in differentiating tubercle bacilli from other acid-fast bacilli. The statement has been made by Wolff[5] that while 0.5 to 2 c.c. of tuberculin will be tolerated without discomfort by a healthy guinea-pig, an injection of 0.1 to 0.15 c.c. will cause the death of a tuberculous pig within twenty-four to forty-eight hours. Attempts to utilize

[1] Berl. klin. Woch., 1907, No. 17, 511.
[2] Ibid., 1908, 171.
[3] Revue de méd. 1906, xxvi, 2.
[4] Hygienic Laboratory, Bulletin, No. 41, United States Public Health and Marine Hospital Service, January 1, 1908.
[5] Berl. klin. Woch., 1908, 297.

the von Pirquet reaction in guinea-pigs have been nearly uniformly failures.

I endeavored first to determine how soon after being inoculated a pig would die from the tuberculin reaction. Injections of tuberculin in doses of 0.25 c.c. and 0.5 c.c. given to healthy guinea-pigs resulted in no appreciable effects. Three guinea-pigs were then inoculated under the skin of the abdomen with an emulsion of very small numbers of tubercle bacilli. At the end of eight, twelve, and fifteen days the animals were given in turn 0.25 c.c. of tuberculin. The one given tuberculin on the eighth day showed no effects at the end of twenty-four hours, and even gained slightly in weight. The one given tuberculin on the twelfth day was sick the next day, but recovered. The nodule at the site of inoculation was larger than it had been the day before, and the pig lost slightly in weight. The one given tuberculin on the fifteenth day was sick the two following days and in other respects behaved like the one preceding, losing slightly in weight and showing a larger harder nodule on the abdomen. All three pigs were autopsied on the seventeenth day. In each there was slight caseation at the site of inoculation and much serous exudate in the adjacent cellular tissue. In this exudate, as well in the caseous material, very large numbers of tubercle bacilli were found. In the pig that had received tuberculin on the eighth day there were miliary tubercles in the liver and spleen. In all the pigs the inguinal lymphatic glands were caseous and contained many tubercle bacilli.

Having failed to get satisfactory results by awaiting the death of the guinea-pigs, but judging that the very large numbers of bacilli found at autopsy were in some way due to the tuberculin, a second series of pigs was inoculated with 0.5 c.c. of an emulsion of tubercle bacilli made so dilute that only two or three bacilli could be found microscopically in an hour's search. These pigs were given 0.25 c.c. of tuberculin at various intervals and chloroformed and autopsied at the end of twenty-four hours. In this manner tubercle bacilli were recovered from the point of inoculation in the subcutaneous tissue as early as the sixth, seventh, eighth, and ninth days. Pigs autopsied on the fourth and fifth days were negative. In one killed on the third day three bacilli were found in a search of an hour and a half. A dose of 0.25 c.c. of tuberculin is such an overwhelmingly large one for a guinea-pig that it was found that size or age of the animal made no difference in the results.

Attention was then given to the possible clinical value of the foregoing suggestions. Pigs were inoculated with suspected material by injecting an emulsion of it under the skin of the left side of the abdomen, the other side being left for the subsequent subcutaneous injection of tuberculin. Each pig was chloroformed and autopsied twenty-four hours after the latter injection. The results were as follows:

1. Pus from empyema. Microscopically no tubercle bacilli; 2.5 c.c. of emulsion of this injected into pig. Tuberculin sixth day. Autopsy, seventh day. A few tubercle bacilli found at site of inoculation.

2. Fluid from tenosynovitis of knee of long standing. No tubercle bacilli microscopically. Tuberculin sixth day. A few tubercle bacilli found at site of inoculation on the seventh day.

3. Suspected tuberculosis of the knee of two years' duration. Not possible to demonstrate tubercle bacilli in fluid from the joint. First pig given tuberculin on sixth day. Autopsy on seventh day. Negative result. Second pig given tuberculin on fourteenth day. Death of animal in twenty hours from reaction. Very large numbers of tubercle bacilli at point of inoculation, which showed caseation and much serous exudate. There were also miliary tubercles in the liver and spleen.

4. Suspected tuberculosis of the ankle-joint. Scrapings emulsified and injected. No tubercle bacilli microscopically. Tuberculin on seventh day. A few tubercle bacilli found at autopsy on the eighth day.

5. Suspected tuberculosis of the kidney. Patient a woman, aged thirty-four years, considerably emaciated, slight irregular fever and a large tender displaced right kidney. The urine contained pus and blood and very large numbers of acid-fast bacilli which were decolorized by alcohol. Two pigs inoculated. Both given tuberculin on the fourteenth day. An abscess had formed under the skin. Pus from this showed no tubercle bacilli after the tuberculin. Pigs killed six weeks after inoculation showed no tuberculosis. Patient has recovered.

A second group showed negative results:

1. Scrapings from fistula into suspected tuberculous hip-joint. Pigs examined on seventh and sixteenth days.

2. Scrapings from fistula into suspected tuberculous hip-joint. Pig examined on seventeenth day.

3. Fluid from symptomatic hydrocele in case of suspected tuberculous testicle. Sections of the testis did not reveal tuberculosis. Pigs examined on the seventh, fifteenth, and thirty-first days.

4. Emulsion from caseous peribronchial gland, which contained tubercle bacilli microscopically, from a child dead of tuberculous meningitis. One pig examined on the eleventh day. The failure in this case suggested the possibility that the child had died of bovine tuberculosis and that tuberculin from human bacilli had no effect.

Of the 62 guinea-pigs used, none died of mixed infectious. One died from tuberculin reaction on the fourteenth day. One with advanced pulmonary tuberculosis of eight weeks' duration, in which there was caseation, survived 0.25 c.c. of tuberculin four days. Pigs No. 51 and 52 were inoculated with the same quantity of the same material at the same time. Both were autopsied on the seventeenth

day, one having been given tuberculin the day before. In both tubercle bacilli were found at the point of inoculation, but by far the larger number were present in that pig to which tuberculin had been administered. It appears that overwhelming doses of tuberculin given to a guinea-pig the subject of tuberculosis breaks down its resistance to the tubercle bacilli and results in their much more rapid multiplication.

The method employed in carrying out this test has simplicity to commend it and the fact that positive results are conclusive. The technique consists of making an emulsion of the suspected material in normal salt solution, if it is not already fluid enough to be injected through a course syringe or sharp-pointed improvised pipette. Three guinea-pigs are inoculated by injecting a considerable quantity under the skin of the abdomen. At the end of six days one pig is given 0.25 c.c. of tuberculin hypodermically on the other side of the abdomen, and is chloroformed at the end of twenty-four hours, and autopsied. The fluids at the site of the original inoculation are smeared upon a slide and examined in the ordinary way for tubercle bacilli. If the first pig results negatively, another is examined in the same way by giving tuberculin at the end of two weeks, and making the autopsy at the end of twenty-four hours. If this is also negative, the third pig is given tuberculin at the end of four to six weeks, and the result of its examination is a check upon the first two.

The test offers a means, in a considerable proportion of cases, of making a diagnosis at the end of a week instead of awaiting until the lapse of four to eight weeks. It also presents a method of distinguishing tubercle bacilli from other acid-fast bacilli, especially when, as often happens, they are present in large numbers.

REVIEWS.

THE FAITH AND WORKS OF CHRISTIAN SCIENCE. By the author of *Confessio Medici*. New York: MacMillan, 1909.

THE author of that delightful book *Confessio Medici*, a little volume which received less notice than its charm of style and contents deserved, has made an examination of the pretensions of Christian Science, that is amusing, instructive, and enlightening. It is probable that no book, however well done, will convert any believer from the queer faith of Eddyism, but a work like this may serve at least as a prophylactic measure. The large number of the half-informed will find here cool consideration of the foggy inconsequences, the feminine illogicalities, the crude half truths of the New Thought, with an amazing list of the kind of cures on which it founds its claims of miraculous healing. The most miraculous thing about the whole matter is that in a nation with so highly developed and so widely diffused a sense of humor as the American, many thousands of people can be found who can read, nay, have some sort of feeling which they call belief in, such preposterous juggling with words as this, for example:

"Erudite systems of philosophy and religion melted for Love unveiled the healing promise and potency of a present spiritual afflatus." "Unveiling" an "afflatus," and a spiritual one at that, must be a really remarkable feat. With such scraps from a feast of languages the author plays pleasantly now and then, but there is enough of serious criticism, too—criticism of the indecent parody by Christian Science of the Christian Faith; criticism of the intellectual cruelty, of the contempt for the weak, which is one of the results of the crooked upside down nonsense about the absence of pain, of death, of sickness; criticism of a most caustic kind of the contradictions of which it is so full; and finally, a list of 200 cases of "cures," given with little comment. Most of these for the doctor carry their own criticism, and although many quotations might be made from the book, we will select only a few of these amazing case histories as samples:

Case 2: "Headaches" and "bowel trouble" healed after two years of Christian Science treatment." Every practitioner knows as a matter of daily experience that patients mean constipation when they speak of "bowel trouble"—so this seems a longish spell of treatment. *Case* 18 was healed of "stomach trouble" and of headaches.

"Stomach trouble" is another dispensary synonym for constipation. *Case* 34 broke one of the bones of her leg. It was properly set and bandaged by a medical man. In *three weeks* she began to walk round the room. *Case* 37 for ten years had a "complication of diseases." Also had weak eyesight and "stomach trouble." *Case* 38 for ten years studied "mysticism, occultism, and Vedastic philosophy." At the end of this time she felt "confused, restless, impatient, irritable, and nervous!" Healed.

The book will furnish admirable ammunition for anyone who wishes to argue the Christian Science question, and is excellent reading besides. J. K. M.

THE EMMANUEL MOVEMENT IN A NEW ENGLAND TOWN. By REV. L. P. POWELL. New York: Putnam, 1909.

THE Rev. Lyman P. Powell, who has written books on Christian Science and on the art of sleep, has cultivated successfully the Emmanuel movement and keeps it going in Northampton. He starts off with gathered quotations from doctors who have deprecated the excessive use of drugs as formerly practised, in a page which sums them up, as if Sir Frederick Treves, Hayem, Metchnikoff, Behring, Roux, Erlich, Barker, and others had condemned the use of drugs altogether. It would be curious to examine the statements in the originals from which he takes these views. It is certainly interesting that of the seven continental names which he quotes, at least five are associated in the minds of the profession with treatment by physical agencies differing widely from the purely mental means of the Emmanuel movement. We do not count Dubois among the authorities, although, with that lack of perspective and real scientific knowledge which characterizes the use of authorities in Dr. Worcester's *Religion and Medicine*, his pupil has spoken of Dubois as if Dubois and Hayem, Behring and Erlich, were all in one class.

It is difficult to criticise in any reasonable fashion the kaleidoscopic changes of the Emmanuel Movement and the rapid changes of its promoters, at first independent of the doctors, although with a kind of dummy board of directors, then with a staff of attendants and a combination medicospiritual clinic, then receiving patients with the approval of the doctors, and finally giving up the church feature altogether and abrogating clinics, and now only receiving patients when recommended directly by physicians.

Mr. Powell, however, has at least a better atmosphere in his book than prevails in Dr. Worcester's. It gives an impression of honest effort, without an eye on the gallery, and none of that general effect of promoting a clearing house for nervous diseases, which some

neurologists thought was likely to be the result of the Boston movement. It is perhaps some such fear that has caused the changes in Emmanuel Church itself. Like the rest of the followers of the Emmanuel movement, he calls a good deal on great names and conjures with Professor William James and Dr. Weir Mitchell. Perhaps, like Dr. Worcester, he has forgotten that while Professor James has taken to spiritualism and the worship of all sorts of strange gods, Dr. Mitchell has busily and publicly denied approving of the Emmanuel movement or having anything to do with its promotion beyond those suggestions which Dr. Worcester drew from the neurologist's published works.

Mr. Powell is not so inclined to sneer at the doctors as Dr. Worcester and his assistants, but he remains equally astonished with his teacher at having secured results which every doctor who knew his business and who had especially studied this kind of thing had been securing for some thousands of years. One observes with pleasure that he mentions that he has had failures. From most of the Emmanuel literature one would suppose that the treatment had this divine quality, if no other, that it could never be wrong.

J. K. M.

THE MATTER WITH NERVOUSNESS. By H. C. SAWYER, M.D., San Francisco: Cunningham, Curtiss & Welch, 1909.

THIS is an awkwardly extravagant little book, fantastic in its language, yet full of common sense, and driving home, even with its extravagance, excellent lessons in the hygiene of nervousness. In the introduction the author puts the case thus; "Priests, psychologists, laymen, are all taking a hand at it (nerve cure); only the doctors are a little abashed. . . . Why should our lay brothers feel impelled to discuss nerve cure? It must be because we want something in this field; we are not always wise, earnest, helpful here. . . . There is one lesson we all need to learn and to heed: every movement away from the authority and the care of scientific medicine marks some real limitation of medical science or else some limitation of the individual men and women who represent it. . . . There are three medicines, the medicine of the spirit, the medicine of the mind, and the medicine of the body. . . . Our gospel today . . . says and insists and repeats even to weariness two pregnant truths. Nervousness is no merely functional trouble; there are no merely functional troubles; . . . whether it be slight or severe, transient or permanent, [it] is always a surface sign of deep-lying bodily deteriorations that are as real as the fracture of a bone. And nerve cure is no marvel of miracle-making for modern men, no mere parlor magic, [but] a struggle just as real, just as earnest, just as desperate sometimes as bone cure is."

To the neurologist this is almost a truism, but certainly it is a lesson that needs enforcing on the general practitioner. Dr. Sawyer takes up the various items of original faulty material, defective construction, wear and tear of the nervous apparatus, and goes into all the details of nose, throat, tooth, womb, eye, and ear disturbances that make for nervousness, the external poisons, the chronic fatigue. They are all listed, but without much perspective and with scarcely sufficient stress on the central fact which, nevertheless, the author evidently wishes to insist upon, namely, that any of these causes are active for ill only when the resistance is lowered in some way. In places this is said in the book, but the whole tone and style is so forced and one might say turgidly colloquial that the point is sometimes missed. The best thing in it is clearly and well put thus: "The largest nerve cure is that which tries to comprehend all the forces that make and mar the nerves; the wisest is that which discovers the individual need that exists in every case—and ministers to it."

J. K. M.

A Text-book of Physiological Chemistry for Students of Medicine and Physicians. By Charles E. Simon, B.A., M.D. Third edition. Philadelphia and New York: Lea Bros. & Co., 1908.

The Elements of the Science of Nutrition. By Graham Lusk, Ph.D., M.A., F.R.S. (Edin). Philadelphia and London: W. B. Saunders Co., 1908.

Chemical Pathology, being a Discussion of General Pathology from the Standpoint of the Chemical Processes Involved. By H. Gideon Wells, Ph.D., M.D. Philadelphia and London: W. B. Saunders Co., 1908.

The three books mentioned in the heading constitute together a very useful mass of information for either advanced student or practitioner. We are now in a period when it is generally recognized that studies of the body chemistry constitute one of the most important branches of investigation in medicine, and while the importance of other lines of work is sometimes slighted in the enthusiasm over work of this class, it cannot be denied that more advances are probable along this line than along most others in the course of the next few years, and certainly more have already occurred along this line recently. The work by Simon is more particularly valuable in the class-room in giving students a clear comprehension of the laboratory side of physiological chemistry. It discusses general questions in relation to physiological chemistry and subsequently gives a chemical discussion of the albumins, carbohydrates, and fats, of the cleavage products of the albumins, of ferments, of the diges-

tive fluids, and the processes of digestion and absorption, of the feces, urine, blood, muscles, nervous tissue, and so forth. It is clearly written and constitutes a very useful text-book on this subject.

As Hofmeister remarked when first putting forth his Beiträge, we may speak of physiological chemistry on the one hand and of chemical physiology on the other hand, and he intended his Beiträge to deal more particularly with the latter subject; the distinction being, of course, that on the one hand the matter was considered chiefly from the chemical standpoint, while from the other point of view chemistry was to be used as the handmaid of physiology. The second and third books under discussion belong to the latter group, in which the attitude is that of dealing with physiology or pathology, using knowledge obtained almost entirely through chemistry in furthering these subjects, but presenting it entirely from the standpoint of the medical sciences rather than from the standpoint of the chemist. Professor Lusk's book is an extremely valuable one and one that cannot fail to be of great use to many men in medical science and to practically every man in the practice of medicine, if he wishes to have a comprehension of that which is in many ways the most important and valuable of all things for him to comprehend, namely, the manner in which the nutrition of the body is accomplished and the methods of furthering or limiting this, together with a discussion of some of the most important disturbances of nutrition. So far as the practitioner is concerned, it is presented with perhaps a little too much of the attitude of the physiologist, but aside from this criticism the book is one that will be of very great service to anyone who desires to gain greater familiarity with the subject; and the fact that it is presented from the standpoint of the careful and precise scientific worker will make it in many ways all the more valuable to the clinician, because there has been altogether too much vague and indefinite impression as against precise investigation prevalent in the clinical study of matters of this kind, and it is only by exact investigations of metabolism that reliable working conclusions can be reached, whether it be for clinical purposes or for more purely scientific purposes. As an example of the truth of the latter statement one may refer to the common indefiniteness in dietetic regulations and to all the vague and erroneous speculation that has gone on in regard to the purin metabolism in its relation to gout, which investigation has so largely checked progress because so many inaccurate conceptions have been exploited and acted upon as a consequence of most unsatisfactory and inexact studies. Dr. Lusk's book takes up seriatum, after an introductory chapter, the study of the feces, starvation, the regulation of temperature, the influence of proteid food, the specific dynamic action of the foodstuffs, the influence of the ingestion of fat and carbohydrate, the influence of mechanical work on metabolism, and then discusses—points that should be most carefully studied by every clinician—the

normal diet and the food requirement during the period of growth, and then metabolism in anemias, in diabetes, in fever, in gout, and other conditions. One point about the book that will be of much value to many persons, and that is only too often eliminated in American books, is a reasonably full and very good working bibliography.

The latter point is shared by Dr. Wells' book on chemical pathology. This is on a subject that is so constantly shifting and changing its position because of the extremely active investigation that is going on in it that any book written on the subject must necessarily be likely to have a limited life, since a very short time serves to alter the point of view in regard to many particulars. Nevertheless, there is much in the book that remains permanent knowledge, since it is based upon well-established facts. It is chiefly in the details that the point of view will change frequently from time to time. Nevertheless, the fact that change must occur rapidly and that therefore books in regard to such subjects are of transitory life is true of any questions that are going through especially active periods of investigation and that are therefore questions of great importance at the time; hence books on such subjects become the more essential in order to have a comprehension of the movements that are occurring. This book in many ways meets the demand that physicians so often make, the demand, that is, for some general discussion that will make comprehensible to the practitioner who has no practical knowledge of chemistry or chemical physiology or pathology the great mass of clinical or semiclinical literature that he sees, which relates to this subject; and a discussion that will at the same time give him a philosophical comprehension of the chemical side of physiology and pathology. The book takes up the chemistry and physics of the cell and of the cell constituents, then considers enzymes and the manner of their action and their general importance in relation to the body processes; bacteria are then discussed from a chemical standpoint, including a consideration of questions of immunity, the chemical means of defence, inflammation and other elementary pathological processes, the disorders of circulation and diseases of the blood, œdema, and the chemistry of tumors; and then a discussion of pathological states, such as uremia, acid intoxication and other intoxications, and the auto-intoxications of gastro-intestinal origin are set forth; finally, the actual diseases of the thyroid, hypophysis, and adrenals, gout and diabetes are discussed at some length.

As has been indicated, these books together present a view of an extremely active field of investigation in a very satisfactory and comprehensive way. D. L. E.

PROGRESSIVE MEDICINE, A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES, AND IMPROVEMENTS IN THE MEDICAL AND SURGICAL SCIENCES. Edited by HOBART EMORY HARE, M.D., Professor of Therapeutics and Materia Medica in the Jefferson Medical College. Assisted by H. R. M. LANDIS, M.D., Demonstrator of Clinical Medicine in the Jefferson Medical College, Philadelphia. Vol. II, 1909. Pp. 317. Philadelphia and New York: Lea & Febiger, 1909.

VOL. II of *Progressive Medicine* for 1909 opens with an excellent discussion of hernia (42 pages) by William B. Coley. Special attention is directed to hernia associated with undescended or maldescended testicle, the radical cure of hernia, accidents occurring in hernia operations, pseudo-incarceration of hernia, and diaphragmatic hernia. Edward M. Foote devotes 78 pages to the surgery of the abdomen exclusive of hernia, especially shock, early rising and thrombosis and embolism after abdominal operations, postoperative ileus and peritonitis, enteroptosis, dilatation of the stomach, gastric and duodenal ulcers, intestinal anastomosis, appendicitis, diverticulitis, megacolon (Hirschsprung's disease), angiocholitis, abscess and cirrhosis of the liver, cholelithiasis, pancreatitis, etc. John G. Clark discusses recent advances in gynecology (74 pages), especially cancer, fibroid tumors, endometritis, metritis, uterine hemorrhage, dysmenorrhœa, sterility and amenorrhœa of obesity, tubal pregnancy, gonorrhœa, genital tuberculosis, etc. Alfred Stengel devotes 70 pages to diseases of the blood and hemopoietic system and disorders of metabolism, especially pernicious anemia, chlorosis, splenic anemia and Banti's disease, polycythemia, Hodgkin's disease, exopthalmic goitre, gout, diabetes, etc. Edward Jackson devotes 26 pages to ophthalmology, especially the ophthalmic reaction to tuberculin and other bacterial extractives, keratitis, inflammations and other diseases of the uveal tract, glaucoma, diabetic cataract, night blindness and other disorders of the retina, etc. The volume is well up to the standard of its predecessors, and the series as a whole is a virtual necessity to him who will keep abreast of progressive medicine.

A. K.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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The Pathogenesis of Pernicious Anemia.—BERGER and TSUCHIGA (*Deut. Archiv f. klin. Med.*, 1909, xcvi, 252) have investigated cases of "cryptogenic" pernicious anemia—cases in which autopsy revealed no adequate cause of the anemia. Tallqvist has shown that Dibothriocephalus latus, which may cause an anemia similar to pernicious anemia, contains a powerfully hemolytic lipoid which can be extracted from the body of the worm, and has been able to demonstrate quite similar substances in the mucosa of the human digestive tract. Berger and Tsuchiga have pursued investigations of like nature, the results of which follow: (1) In pernicious anemia there is present in the gastric and intestinal mucosæ a lipoid substance soluble in ether, which is about ten times as powerful a hemolysin as the lipoid obtained from the normal mucosa. (2) Tested experimentally on animals, this lipoid shows weak but definite hemolytic properties, when administered either subcutaneously or by the stomach. That obtained from the normal mucosa exerts much less action or none at all. (3) The resulting anemia has the characteristics of pernicious anemia. (4) In dogs it is possible to obtain a lipoid similar in action to that in pernicious anemia, after first producing a gastro-intestinal catarrh. (5) The conclusion seems justified that the origin of the so-called cryptogenic form of pernicious anemia is to be found in the hemolytic action of this lipoid material, with secondary insufficiency of the bone marrow. (6) The place of origin of this powerfully hemolytic lipoid is in all probability the gastro-intestinal mucosa; the cause of its production seems to be a chronic inflammation of the mucosa.

Paroxysmal Hemoglobinuria.—MEYER and EMMERICH (*Deut. Archiv f. klin. Med.*, 1909, xcvi, 287) have made a careful and comprehensive study of four cases of paroxysmal hemoglobinuria, confirming the work of Donath and Landsteiner, Hoover and Stone, and others, adding some that is new. They demonstrated the autohemolysin described by Donath and Landsteiner in all four of their cases. In some instances this has been missed by other observers, but the authors find that these negative results are probably due to the fact that often, and especially after a paroxysm, the complement is largely, if not quite, exhausted in the patient's blood. Hemolysis may, however, always be obtained by adding fresh complement. Local lowering of temperature leads to the formation of new complement in the body, probably locally, so that one attack does not prevent an early recurrence of the attack. A few days after a paroxysm the blood contains the normal amount of complement. During the paroxysm both systolic and diastolic blood pressures rise, even before the chill, to decline with the height of the fever. Between attacks there is a lymphocytosis of 30 per cent. to 35 per cent. During an attack the lymphocytes are diminished to 9 to 10 per cent., the decrease being parallel to the severity of the attack; at the same time the eosinophiles diminish or disappear from the blood. The dissolved hemoglobin is excreted partly as urobilinogen. The hemolytic amboceptor is bound to the red blood cells during cooling; it can be separated from them by repeated washing with warm normal saline solution. The red blood cells of patients with this disease are less resistant to changes in temperature and to dilute acid and dilute saponin solutions than those of a normal individual. Toward cold alone they are not more sensitive. Against the patient's hemolysin, however, his own red blood cells are more resistant than normal red corpuscles, which are usually agglutinated by the patient's serum. The serum of the hemoglobinuric possesses hemopsonins, since it causes normal macrophages to phagocytic red blood cells.

The Value of Schurmann's Color Reaction in Lues.—GALAMBOS (*Deut. med. Woch.*, 1909, xxxv, 976) has investigated the color reaction for the diagnosis of syphilis, recently proposed by Schürmann. He finds that the reaction has nothing to do with the luetic or non-luetic nature of the patient's blood serum, and that it is, therefore, valueless as a diagnostic test.

Disseminated Miliary Tuberculosis of the Skin.—WILDER TILESTON (*Archiv. Int. Med.*, 1909, iv, 21) calls attention to the eruption of disseminated miliary tuberculosis of the skin in infants and its importance. Of 32 cases of tuberculosis, osseous, glandular, pulmonary, intestinal, peritoneal, and meningeal, 7 (21 per cent.) showed the eruption. All the children with spots which came to autopsy were found to have miliary tuberculosis. The eruption consists of scattered discrete papules, which at the beginning are the size of pin-heads, and are soon capped by tiny vesicles with purulent contents. Later, the vesicle ruptures or dries up, and its place is taken by a crust. When healed, a tiny white scar surrounded by a halo of brownish pigment remains. They appear in crops so that all stages may be present at

the same time. The distribution is fairly constant, the majority being situated on the buttocks, genitalia, and adjacent portions of the thighs. This is probably due to irritation by urine and feces, with consequent lowered resistance of the skin. Histologically, they vary from necrotic areas to tubercles and caseation. The cause is the tubercle bacillus. It was demonstrated in 70 per cent. of the cases. It probably reaches the skin by the blood stream. This specific eruption Tileston claims is of great diagnostic importance, and of even greater prognostic value than the positive tuberculin reaction. It indicates almost certainly a fatal outcome.

The Condition of the Pancreas in Achylia and Anacidity of the Stomach.—EHRMANN and LEDERER (*Deut. med. Woch.*, 1909, xxxv, 879) point out the widespread belief, based on Pawlow's experiments, that hydrochloric acid is the specific stimulant of pancreatic secretion. In a large number of cases of achylia and anacidity they have tested the gastric contents and feces by Fuld's method and have found an actual increase of trypsin the rule. Their observations were made on 98 patients. The following results were obtained: (1) In achylia and anacidity the pancreatic function, contrary to the general supposition, is not diminished and is often increased. (2) It is, therefore, unnecessary to give hydrochloric acid to stimulate the pancreas in these conditions. (3) The author's experiments indicate that HCl is not the specific stimulant for pancreatic secretion. (4) With Volhard's oil breakfast and Ewald's breakfast, trypsin is usually demonstrable in achylia and anacidity. (5) In hyperacidity it is usually impossible to demonstrate trypsin in the gastric juice. (6) The more bile the gastric contents hold, the richer the trypsin. (7) Exceptions to (6) are not infrequent. (8) The absence or diminution of trypsin in hyperacidity is probably not due to acid alone, but possibly to an absolute decrease in ferment secretion and to the pyloric action. (9) Whether fats cause a physiological passage of pancreatic juice into the stomach of man, as is the case in the dog, remains undetermined.

The Influence of Radium on Uric Acid Salts.—GUDZENT (*Deut. med. Woch.*, 1909, xxxv, 921) has shown in a previous communication that (1) uric acid forms two groups of primary salts, which can be separated solely by their different solubility. The first group (*a*-salt) changes at the time of its production into the second group (*b*-salt), which is more stable. The most probable cause of this change is an intramolecular rearrangement. (2) The *a*-salt, the first to be formed, has a solubility, which at 18° C. is 33.4 per cent. greater than the *b*-salt, while at 37° C. it is 33.9 per cent. more soluble. In the blood, owing to physical chemical laws, it so happens that the solubility of each of these salts is less than in water, the uric acid being present in the blood as the mononatrium urate. In gout the *b*-salt plays a prominent role. The author has sought a method to prevent the formation of the less soluble *b*-salt from the *a*-salt and also to change the *b*-salt back to the *a*-salt. He finds that radium is capable of inhibiting the formation of the *b*-salt. He also believes that he has been able, by this means, to convert the *b*-salt into the *a*-salt, which is twice as soluble as the former in the blood,

The Bacteriology of the Blood in Convalescence from Typhoid Fever.—Coleman and Buxton (*Jour. Med. Research*, 1909, xxi, 83) examined 46 cases of typhoid fever in regard to the bacillemia. They found in the majority of instances that the bacilli disappear from the blood as the temperature falls; that the defervescence and bacillemia are conterminous. They believe that the atrium of infection is the lymphatic structure of the intestinal wall. Thence the bacilli invade the general lymphatic system and spleen, where they grow chiefly and where relatively few are destroyed. A limited number may filter through into the blood in the incubation period of the disease. When the development of the bacilli has reached a certain grade, they overflow in quantity into the blood, where they are destroyed and their endotoxins set free. The symptoms represent the reaction to this. As the disease advances, the growth of the bacilli in the organs may be gradually controlled by the immunity processes, fewer bacilli are discharged into the blood, and the symptoms lessen in severity. At or about the time of defervescence the bacilli practically disappear from the blood. A few may filter through but the symptoms become less and convalescence proceeds. The post-typhoid elevations of temperature may be due to discharges of limited numbers into the blood, the growth in organs not being fully checked. The enlargement of the spleen and subsequent associated relapse suggest that the growth of bacilli there has been brought under only temporary control, and later, rapid multiplication occurs bacilli are discharged into the blood and destroyed, and the symptoms of a relapse become manifest.

A Comparison of the Guaiac and Benzidene Tests for Invisible Hemorrhage in Diseases of the Digestive Organs.—White (*Boston Med. and Surg. Jour.*, 1909, clx, 733) states that the clinical value of the guaiac test for occult blood is established beyond question. The method is simple, has given uniformly negative results with healthy persons on a meat-free diet, and has proved capable of detecting minute invisible hemorrhages in the gastro-intestinal tract. It is everywhere in use as an aid to the diagnosis of cancer and ulcer from the many diseases which may closely resemble them. The clinical value of the benzidene test is less well known. White thinks it important to recognize and use both methods. A preliminary step is necessary in both tests to exclude sources of error from food ferments. Acetic acid-ether extraction is best for the guaiac test, and boiling in the benzidene test. Metallic salts, potassium iodide, and charcoal must not be given when the stomach contents are to be submitted to the latter method. Meat, fish, and their juices must be excluded from the diet and no hemoglobin derivatives administered for two to four days previously. The stomach tube often introduces error by injuring the mucous membrane. Therefore, feces are more reliable. The Weber method is the best guaiac test for routine clinical work, namely, the addition of 10 drops of fresh tincture of guaiac and 30 drops of well-ozonized turpentine to an acetic acid-ether extract of 10 c.c. of feces. Schroeder's statement that each strength of blood solution has an optimum strength of guaiac tincture to obtain the deepest and clearest blue color is correct. It is well, therefore, to use 1, 2, and 10 drops of the usual guaiac tincture. Schlesinger and Holst's modification of the benzidin test is from two to five

times as delicate as the guaiac test. It consists in adding 2 to 3 drops of the boiled feces mixture (a pea-sized piece in 4 c.c. of water) to a mixture of 10 drops of fresh benzidin solution (a knife tip of benzidin in 2 c.c. of glacial acetic acid) and 3 c.c. of commercial hydrogen peroxide. A clear green or blue appears when positive. A negative benzidin test has greater value than a negative guaiac test, and if both tests are used as a control much time will be saved by using the benzidin method first. It takes only two minutes, and if negative, renders further testing for blood unnecessary.

A Serum Reaction in Mental Diseases.—MUCH and HOLZMANN (*Münch. med. Woch.*, 1909, lvi, 1001), in a preliminary report, describe a characteristic serum reaction discovered in the examination of psychiatric cases, which promises much as an aid to diagnosis and prognosis. The principle of the reaction is simple: If human serum is added to cobra venom, hemolysis of washed human corpuscles is not prevented; but if serum be obtained from a patient suffering with dementia præcox or maniac depressive insanity, it is capable of inhibiting hemolysis. The technique used in performing the test is the following: 0.35 c.c. of serum is mixed with 0.25 c.c. of a 1 to 5000 solution of cobra venom (dilution made with physiological salt solution). To the mixture one adds 0.5 c.c. of a 10 per cent. suspension of human corpuscles and then places the tubes in the incubator for two hours and afterward in the ice chest for twenty-two hours. In examining the tubes, they are thoroughly shaken, and if the contents are turbid (lack of complete hemolysis), the result is positive. Controls must, of course, be made with normal serum. In a number of cases examined in this way, the reaction, which Much and Holzmann call the "psychoreaction," has been positive only in dementia præcox or maniac depressive insanity or in a member of a family in which either of these diseases or circular insanity (at times with epilepsy) has existed. Much and Holzmann promise a more detailed report later. They have been unable to obtain the reaction in the cerebrospinal fluid.

Sodium Chloride in Nephritic Œdema.—BLOOKER (*Deutsch. Arch. f. klin. Med.*, 1909, xcvi, 80) has made a careful study of six cases of nephritis with œdema with reference to sodium chloride intake and output. The value of restricted sodium chloride in the treatment of nephritic œdema is still, he believes, an open question. His observations lead him to the following conclusions: (1) Œdema in nephritis is caused by primary sodium chloride retention only in exceptional cases. (2) A salt-free diet is rarely of value in the treatment of nephritic œdema.

The Influence of Various Carbohydrates on Glycosuria.—WERBITZKI (*Ztschr. f. exp. Path. u. Ther.*, 1909, vi, 235) has made a very careful study of the sugar output in diabetes following the eating of various carbohydrate foods. He believes as a result of his observations and a study of the literature that various carbohydrate foods, even though they contain one and the same carbohydrate, may nevertheless lead to greatly varying sugar output. Of the foods rich in starch, oats occupies a conspicuous position, since in many cases of diabetes it leads to no increase in the sugar excreted in the urine. This leads to the supposition that a chemical difference exists between the carbohydrate of oats

and that of most other foods. An oatmeal diet exercises a favorable influence in the majority of cases, not only on the glycosuria, but also on the general condition of the patient, and for this reason it should be more commonly tried in the treatment of diabetes. It should be used to the entire exclusion of other carbohydrates, at any rate until a fair trial has been given it.

The Cultivation of Spirocheta Pallida.—SCHERESCHEWSKY (*Deut. Med. Woch.*, 1909, xxxv, 835), in a preliminary note, gives the result of his attempts to cultivate Spirocheta pallida. Preivously it has been possible to grow the organisms in a collodion sac placed in the peritoneal cavity of an ape. As a culture medium Schereschewsky has used horse serum which he heated to 60° C. until a jelly-like consistency was attained. The culture was made by placing a fresh fragment of a luetic papilloma or condyloma in a centrifuge glass two-thirds full of the medium and corking it after the material had sunk to the bottom. In three to five days the organisms are found in large numbers in the medium. Schereschewsky believes he has made a successful transfer of his culture. A pure culture has not been obtained.

Alimentary Lipemia.—LEVA (*Berl. klin Woch.*, 1909, xlvi, 961) has proposed a simplified technique for the study of alimentary lipemia. In the method of Neisser and Braeuning the patient is given a definite quantity of cream; 15 c.c. of blood are then taken, after a given internal of time, from an arm vein, the serum is allowed to separate, and then the layer of "cream" on the serum is measured after standing four days in the ice chest. Leva examines the serum directly with dark field illumination, and estimates the degree of lipemia by means of the apparent number of fat droplets in the serum. As a test meal he proposes 45 grams of white bread, 20 grams of butter, and a cup of tea without milk. As yet, the number of patients examined is too small to permit one to draw any definite conclusions. He has tested olive oil and cream nutrient enemas in that way and finds that very little of the fat is absorbed. Leva confirms the work of other observers to the effect that hemoconia are in reality fatty particles.

Meat as a Source of Infection in Tuberculosis.—LITTLEJOHN (*Practitioner*, 1909, lxxxii, 843) states that the risk of contracting tuberculosis by eating the meat of tuberculous animals is not so great as generally believed. Imperfect inspection makes the risk greater than it should be, a risk which concerns especially those who buy cheap meat and eat such commonly infected organs as the lungs, udder. and mesenteries. The relative infrequency of tuberculosis in all but cattle and pigs makes them the only food animals at all dangerous to man. The flesh of tuberculous animals is not necessarily infectious, and when so, in many instances, it is due to secondary contamination by means of the knife, butcher's cloth, and dressing. Cooking is sufficient ordinarily to destroy tubercle bacilli on the outside of a roll or joint, but not in the centre. Digestion, salting, or smoking have little or no disinfecting effect. However, the rarity of tuberculous foci in the flesh, even in advanced cases, makes ordinary cooking efficient if the thick rolls and joints are avoided and the meat is well done.

SURGERY.

UNDER THE CHARGE OF

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The Operative Treatment of Ascites Due to Cirrhosis of the Liver.—SOYESIMA (*Deut. Ztschr. f. Chir.*, 1909, xcviii, 390) reports three cases in which Routte's operation for draining the peritoneal fluid into the long saphenous vein, was performed. In the first case this operation had been preceded by several others: August 31, 1906, the omentum was sutured to the subcutaneous tissue of the abdominal wall; October 9, 1906, the left kidney was decapsulated, and six weeks later the right kidney; December 17, a silver cannula was introduced into the peritoneal cavity in the ileocecal region for permanent drainage. These operations were without important results. December 10, 1907, an incision was made in the upper inner surface of the left thigh over the course of the long saphenous vein, from a point 2 cm. above Poupart's ligament, obliquely downward and inward, about 17 cm. long. From its entrance into the femoral vein, the long saphenous was freed about 8 cm. downward, and divided somewhat obliquely. The diameter of its lumen was about 3 mm. The peripheral stump was ligated and the central stump turned upward and outward over Poupart's ligament. Just above the ligament an incision was made about 1 cm. long in the peritoneum, and the open end of the central stump of the saphenous vein was anastomosed into this opening and fixed by five catgut sutures, No. 0, so that not a drop of the ascitic fluid escaped. Gauze drainage was used and a collodion dressing applied. The drainage was removed on the second day. Healing by first intention followed. The quantity of urine increased somewhat after the operation, but the abdomen again gradually distended. On December 19, 1907, a similar operation was done on the right side. On July 7, 1908, it was noted that the daily quantity of urine was, on an average, 1460 c.c. No more punctures were necessary since the last operation, and the general condition was much improved. The abdomen was still moderately distended, but was not tense. The pulse was strong and regular, 72 per minute. On December 11, 1908, the patient felt well and the abdomen was becoming smaller. In the second case the operation was not successful, and the patient died. Autopsy showed both saphenous veins completely obliterated. In the third case at autopsy the communications between the saphenous vein and peritoneal cavity were about large enough to admit a pin. On the right side it could not be probed, but on the left side it could be probed about 12 cm. The Talma-Drummond operation, the production of adhesions between the

omentum and anterior abdominal wall, with its modifications, is indicated only in the early stages of the disease. The Routte operation, the anastomosis between the peritoneal cavity and saphenous vein, is worthy of trial in very bad cases.

The Surgical Treatment of Gastric Ulcer.—CLAIRMONT (*Mitt. a. d. Grenzgeb. d. Med. u. Chir.* 1909, xx, 330) says that of 259 cases of gastric ulcer operated on in one of von Eiselsberg's clinics during the past ten years, the mortality has been diminished from 24.5 per cent. to 6.6 per cent. By the employment of posterior, retrocolic gastro-enterostomy it was diminished from 16.6 per cent. to 3.5 per cent. The late results after gastro-enterostomy are not as favorable as in Krönlein's statistics, Krönlein reported a complete cure in 61 per cent., and a considerable improvement in 24 per cent. In Clairmont's cases complete healing occurred in 52 per cent. and improvement in 15 per cent. The influence of gastro-enterostomy on gastric ulcers will depend upon the position of the ulcer in the stomach. The nearer the ulcer to the small intestine the more favorable will be the prognosis. Ulcers at the pylorus or in its neighborhood were influenced favorably by gastro-enterostomy in 62 per cent. of the cases, those removed from the pylorus in 47 per cent., and those in the duodenum in 73 per cent. The failures occurred particularly in those cases in which the ulcers were distant from the pylorus, those in which there developed peptic ulcers at the anastomosis, and in those in which the anastomotic opening became secondarily contracted or closed. Since in only 3 per cent. of his cases there were lacking such changes in the stomach wall that the site of the ulcer could not be recognized from the outside, the situation of the ulcer in the stomach can be determined by the surgeon in almost all cases, which fact is of value in determining the choice of operation. Often the location and time of the occurrence of the pain will permit a proper topical diagnosis of the ulcer. Those ulcers having associated with them an inflammatory tumor formation, as well as the penetrating ulcers, give an especially favorable prognosis from the standpoint of operation, provided they are not too far removed from the pylorus.

The Results of Spinal Anesthesia, Especially in Laparotomies.—ZAHRADNICKY (*Archiv f. klin. Chir.*, 1909, lxxxix, 371) reports 1650 cases in which spinal anesthesia was employed, since 1900. He followed closely the indications given by Bier and Dönitz and strongly approves of them. In four cases he failed to enter the spinal canal. This happened particularly in old people in whom the cartilage is usually ossified, in those in whom the lumbar spine is flat, or when there was an abnormal curve of the spine. In two cases the injection needle was broken off in the removal of the needle, and an incision was necessary to find and remove the broken off part. In the beginning α-eucaine was employed (81 cases). β-eucaine was used in only 7 cases. Better results were obtained from the use of tropacocaine, which was employed in 367 cases. Suprarenal extract combined with each of these substances improved and deepened the anesthesia. Still better results were obtained from the use of stovain and novocain. The latter was finally selected as the best anesthetic and was employed in 859 cases.

Suprarenal extract was combined in 667 of these, but in the last 192 cases the novocain was used alone. Gradually the suprarenal extract was found to be undesirable. The novocain was given in doses of 0.17 gram, which gave complete anesthesia in 91.1 per cent. of the cases, and this lasted one and one-half, two, or three hours, and was deep. Incomplete anesthesia was observed in 2.3 per cent. of the cases, and general narcosis was added in 3.9 per cent. Collapse occurred in 0.03 per cent., vomiting during the operation in 10 per cent. (very frequently in laparotomies and herniæ). The pulse was slowed or increased in only 1.7 per cent. of the cases, while in 52.5 per cent. paresis of the sphincter ani and lower extremities occurred, but these were only transitory and without consequence. The temperature only rarely (2.2 per cent.) rose to 38°. Headache also was not frequent and was of slight intensity (13 per cent.) Vomiting after operation occurred in 9.8 per cent., mostly in laparotomies and herniæ. Sleeplessness was observed in 33.5 per cent. of the cases, while retention of urine and hyperalgesia of the wound was observed in only a few cases. The Trendelenburg position aided much in obtaining anesthesia in all affections of the abdominal organs. In 226 laparotomies complete anesthesia was obtained in 212, incomplete in 14, while in 8 cases general anesthesia was necessary. The anesthesia generally reached up to the costal arch and mammary glands, many times to the clavicle. Only in a few cases did it fail to reach the costal arch, and the lowest level to which it extended was the umbilicus. Spinal anesthesia has the advantage over general anesthesia that it produces no bad effects on the heart and lungs, and, according to Zahradnicky's experience, no bad effects on the kidneys, which occurred with the use of stovain.

Late Development of Deformity in Consequence of Fracture.—Zesas (*Archiv gen. d. chir.*, 1909, iii, 471) reports the case of a man, aged thirty-two years, who in November, 1906, fractured the upper fourth of the right leg. The limb was in very good position. Three days after the accident a plaster cast was applied and was left on fifty-two days. On its removal the fracture had consolidated, and the leg was straight, without the least deformity. Crutches were then used and there was no pain. At the end of the fourth month the patient began to work. About twelve months after the accident the patient began to have acute pain at the seat of fracture, principally at night. A little later he observed a slight deformity of the leg, but he continued to work. Zesas saw him for the first time in November, 1908, two years after the accident. Four months before this time the pain had disappeared, but the patient continued to limp, although the deformity had made no progress. At the juncture of the upper and middle thirds of the leg was a well marked curve, concave internally, giving the limb the aspect of a genu varum. There was a voluminous solid callus at the seat of fracture. In walking the foot rested chiefly on its external surface. In connection with the reports of similar cases, two pathogenic theories are offered—deficient ossification of the callus and repeated fractures of the callus. The callus remains cartilaginous in some cases longer than usual, and it is possible that in the cases which develop these deformities, it had not ossified when walking was begun. Such callus may harden later,

making the deformity permanent. Sometimes the callus is strong enough to permit walking, and then yields to violence not sufficient to break a normal bone. In Zesas' case, when the patient began to walk the callus was solid, and there was no movement or pain at the seat of fracture. The patient said that he had sustained no violence or traumatism since the accident. The pain which preceded and accompanied the development of the deformity can only be explained by an inflammatory process in the callus. Probably in certain cases an inflammation of the callus can produce a rarifaction and softening of the bony tissue. While it would be difficult to determine the exact cause of the osteitis, it is not impossible that it was due to slight breaches in the newformed osseous tissue.

Concerning Uranoplasty.—RANZI (*Archiv f. klin. Chir.*, 1909, lxxxix, 609) reports the results of a statistical study of 61 operations for cleft palate, performed in v. Eiselsberg's clinic, between 1904 and 1908. Of 22 cases operated on by the Lane method, 5 resulted in a complete closure of the cleft, in 7 a small defect was left, in 4 a partial closure resulted, and in 6 the operation was a failure. Two patients died as the result of the operation and three died later. In spite of the good results reported by Lane in 200 cases, this operation has not many supporters among German surgeons. Of 32 cases operated on by the Langenback (Billroth) method, with its modifications, in 13 there was a complete closure of the cleft, in 7 a small defect was left, in 6 a partial closure was obtained, and in 6 the operation was a failure. There was no death from the operation in this series, but one patient died later. A comparison of the results shows that both operations were followed by about the same proportion of failures and partial closures. From the Lngaenbeck operation, however, there were 27.7 per cent. of complete closures, while from the Lane operation there were only 22 per cent. In 31 per cent, there were left small defects. The dangers of operation soon after birth, when Lane advises operation, are very serious. Of operations done in the first days after birth, the mortality was 66 per cent., in the first year 37 per cent., and in the second year 12.5 per cent. When the cases of complete healing of the cleft and those with small defects are collected together, it is found that there were none from the operations done in the first days of life, 37.5 per cent. in the first year of life, 37.5 per cent. in the second year, 68 per cent. from the second to the sixth year, 77 per cent. from the sixth to the fourteenth year, and 75 per cent. above the eleventh year. These figures speak strongly against the early operation. On account of the lessened tension on the flaps in the Lane operation, it is especially adapted for cases with wide clefts. On the other hand in the Langenbeck-Billroth operation, the nourishment of the flaps is better, so that it should be preferred for operations on narrow clefts. The Bunge method of introducing the sutures is to be preferred, because it gives the best anatomical results. Uranoplasty is best done soon after the second year.

A New Method of Operating for Habitual Dislocation of the Shoulder by Muscle Transplantation.—CLAIRMONT and EHRLICHER (*Archiv f. klin. Chir.*, 1909, lxxxix, 798) accept the causes and the groups of

cases given by Perthes, which the latter based upon the previously published autopsy and operative findings in habitual dislocation of the shoulder. Perthes divided the cases into three groups: (1) Consisting of the cases in which there is a tearing away of the muscles from the greater tuberosity; (2) cases in which there is a tearing or breaking away of the capsule from the margin of the glenoid cavity; and (3) cases in which the capsule is relaxed. After critically examining the various methods of operation, he can see that the only cause of success of the operations is in the contraction of the capsule, which was done in all of them. Still we should seek simpler methods. The incision for exposing the capsule, especially when the deltoid is temporarily detached, makes relatively too severe an operation. The writers have obtained good results in two cases by transplanting a muscle flap taken from the posterior portion of the deltoid and attaching it to the head or surgical neck of the humerus, in order that it may prevent the head from passing forward into the dislocated position, from the contraction of the muscles on the inner side. In view of the numerous pathological causes, based upon anatomical grounds, for the occurrence of these dislocations, there is need of a uniform method of operation, applicable to the greatest number of cases, and less severe than those now in use. Since the habitual dislocation is actually due to a lack of coördination of the normal muscular contractions, one is justified in ignoring the changes in the articulating surfaces and the capsule, and in preventing the tendency to luxation by the effect of an antagonistic muscle. This can be accomplished by the formation of a flap from the posterior portion of the deltoid muscle, with its base at the spine of the scapula. The free end is passed through an opening made for it around the posterior part of the neck of the humerus to the anterior medial part of the deltoid, where it becomes united, with preservation of its contractility. This method can be employed in the greatest number of cases. It avoids opening the joint. The free return of movements is rapid, without the necessity of after treatment.

An Anatomical and Mechanical Study of the Shoulder-joint.—GOLDTHWAIT (*Amer. Jour. Orthop. Surg.*, 1909, vi, 579) made an anatomical and mechanical study of the shoulder upon the cadaver, and combined this with a study of clinical cases. Most of the cases could be arranged in three groups. The first and largest group was characterized by pain and limitation of movement in the shoulder, chiefly of rotation. These cases have been most often designated as rheumatism, periarthritis, or neuritis. The second group consisted of those cases with instability of the joint and recurring dislocations. In the third group are those cases with pain in the arm, frequently referred to definite points, sometimes to the distribution of a single nerve, most often the ulnar. The anatomical features seem to be the same in all, as well as many of the principles of treatment. Goldthwait calls attention to the variations in form, length, and position of the coracoid and acromion processes, and says that normally the tip of the coracoid rests against or is opposite the lesser tuberosity. The amount of contact between these bones depends upon the shape of the bones and the position of the shoulder with reference to the rest of the body. In the position of drooped shoulder

the point of contact of the coracoid with the humerus is made necessarily lower and must be more constant. There is from 50 to 60 degrees more rotation of the humerus in this than in the erect position of the shoulder. In a similar manner, an acromion process, longer than normal, is brought in contact with the greater tuberosity, an abduction of the arm, earlier and more forcibly than usual occurs, and then the head of the humerus tends to be forced out of the glenoid cavity. To prevent undue irritation from the impingement of the bones against each other, bursæ exist, the subdeltoid or subacromial, on the one hand, and the subcoracoid or coracobrachialis on the other. The painful shoulders result usually from inflammation of one or other of these bursæ, which is aggravated or may be caused by the position of round or drooped shoulder, since in this position the bony surfaces are brought more forcibly together. After the acute symptoms have subsided the development of adhesions gives rise to limitation of motion in the shoulder. Goldthwait accounts for the third group of cases, the brachial neuralgias, by the position of the head of the humerus in drooped shoulders. In this position the ulnar nerve lies directly under the head of the bone, this being the most posterior of the branches of the plexus, and it is pressed upon as it crosses the second rib. If the subcutaneous fat tissue is present in considerable amount, the pressure exerted is more apt to be upon all the axillary structures, the pressure upon the individual nerve being less easily possible, and the more general pain is the result. The treatment of all the different conditions, although widely different clinically, is practically the same except for minor details. The first requisite consists in changing the forward position of round or drooping shoulder, so that it is held erect. There is then no undue pressure on any of the structures; the stability of the shoulder-joint is increased, so that displacements are difficult of occurrence; the bursæ are no longer unduly irritated; and the axillary structures cannot be compressed. If adhesions exist between the bursal surfaces, they can be overcome by proper manipulations under an anesthetic.

THERAPEUTICS.

UNDER THE CHARGE OF

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The Treatment of Gastric Ulcer by Immediate Feeding.—SPRIGGS (*Brit. Med. Jour.*, 1909, i, 825) summarizes the principles of the Lenhartz treatment of gastric ulcer as follows: (1) Complete rest in bed for four weeks; (2) feeding the patient from the beginning of the attack with small quantities of beaten-up eggs and milk, the quantities being increased daily; (3) the application of an ice bag to the epigastrium;

(4) adding to the dietary boiled rice, minced meat, and other semisolid and solid foods after the first week; (5) the administration of bismuth and iron in suitable form. Of these, the complete rest in bed, the bismuth and iron, and the ice bag are commonly advised by physicians; but the plan of allowing food to be put into the ulcerated stomach at the beginning of the attack is contrary to the usual practice. The detailed routine of the Lenhartz treatment was given in an article in this journal (1908, cxxxvi, 18). Spriggs discusses the theory of the action of the Lenhartz treatment and calls attention to some of the disadvantages of the old method of rectal feeding. He mentions, as chief among these disadvantages, the considerable period of starvation or semistarvation and the less successful the treatment is, the longer is the period of starvation. Rectal feeding is tedious, unpleasant, and difficult of application outside of hospitals. Spriggs gives a brief review of the published cases treated by the Lenhartz method. Wagner, in 1904, reported 60 cases, 35 of which had no pain from the beginning of the treatment. In only six of this series did the pain persist beyond the first week of treatment. Haberman, in 1906, reported 135 cases treated by Lenhartz, with only three deaths. Hemorrhage occurred in only 8 per cent., as compared with 20 per cent. in 100 cases treated by the older method. Wirsung reported 42 cases with very favorable results. He found that 27 of these cases showed a less amount of hydrochloric acid after test meals as a result of the treatment. Lenhartz, in 1906, reported 140 cases, all with recent hematemesis or melena, with a mortality of 2.14 per cent. Lambert, in 1908, reported five severe cases, all of which did well on the treatment. Berger thinks that the treatment may be of diagnostic value, for, if patients do not do well, the disease is probably not ulcer. He cites 6 cases in which the failure of the diet led to the diagnosis of a gastric cancer, confirmed in four of them by operation and in two of them by autopsy. In another case, hemorrhage was due to cirrhosis of the liver. He says, further, that in cases of epigastric pain without bleeding, which do not yield to the Lenhartz treatment, nervous disease may be suspected. Schnütgen, in 1907, reported that Lenhartz had then treated 201 cases. with a mortality of 3 per cent., compared with 195 cases treated by Leube with a mortality of 4 per cent. Leube has collected a total of 556 cases treated by nutrient enemas, with a mortailty of 2.2 per cent. Many of these cases, however, were not severe enough to be hospital cases. Ewald uses nutrient enemas for three days after hemorrhage, then substantially follows the Lenhartz method. In 1906 he reported 34 cases, with 14 deaths, occurring either during the treatment or after operation. He condemns the Lenhartz treatment as unsatisfactory, but, as Spriggs remarks, the Lenhartz results are better than Ewald's. Spriggs' paper is based upon 33 cases treated by the Lenhartz method and 34 cases treated by the ordinary methods. He arrives at the following conclusions: (1) The Lenhartz treatment is not more dangerous than treatment by nutrient and saline enemas followed by a graduated milk diet. In these particular cases the recurrence of hemorrhage was less frequent, and there were no deaths. (2) The pain suffered by the patient in the course of the treatment is less on the Lenhartz diet. (3) The diet gives far more nourishment than can be introduced into the body by nutrient enemas, and is, therefore, more desirable in patients, who have frequently been for a long time in a state of semistarvation, or have suffered a loss of blood, or both. In

addition, the Lenhartz treatment enables the patient to take ordinary diet without pain in a much shorter time than the treatment by nutrient enemas. (4) In patients treated by this method rectal injections may be entirely avoided. This is an advantage in a hospital and a still greater advantage in treating patients at their homes, where rectal injections are not only regarded as extremely unpleasant, but are seldom efficiently administered.

Bismuth Poisoning and a Non-toxic Substitute for Bismuth in Roentgen-ray Work.—LEWIN (*Münch med. Woch.*, 1909, xiii, 643) maintains that the symptoms of bismuth intoxication are due to the bismuth itself, and not to the production of nitrites. Consequently, he believes that it is useless to substitute other forms of bismuth for the subnitrate in Röntgen-ray work. In this opinion he disagrees entirely with the majority of other observers upon the same subject. Lewin has experimented in order to discover a substitute for bismuth and recommends for this purpose the magnetic oxide of iron. This is insoluble in the stomach and intestines, and admirably arrests the rays. He states that Röntgen pictures taken with the magnetic oxide of iron are far superior to those he has ever obtained with bismuth.

Vaccines in Typhoid.—WALTERS AND EATON (*Boston Med. and Surg. Jour.*, 1909, xvi, 509) report a further series of cases treated by the hypodermic administrations of vaccines made from dead bacilli. They give in detail the histories of a family consisting of a mother and three children, all attacked by the disease at the same time. Two of the children, who received vaccines improved rapidly. A rapid fall in temperature was noted soon after the treatment was begun. The youngest child had been the least sick, and was not inoculated. The child became steadily worse, and on the fourteenth day of the disease the temperature was 104.8°. The vaccine was then administered and the temperature fell immediately with a marked improvement in the other clinical symptoms. They note that of 77 cases of typhoid fever treated during 1908, 31 received the vaccine treatment. The remaining cases received the ordinary routine treatment. The mortality of the cases treated with vaccines was 3.2 per cent. as compared with a mortality of 11.1 per cent. in the cases not thus treated. In all, Walters and Eaton have now observed about forty cases treated by this method, and they believe that the early administrations of vaccines shortens the duration of the disease and also lessens the severity of the symptoms.

Physiological and Therapeutic Properties of Serum of Milk (Lactoserum).—BLONDEL (*Lancet*, 1909, 1,1038) has performed some very interesting experiments with the serum of cow's milk. He obtains this serum in the following manner: Fresh milk is warmed to 30° C. and rapidly coagulated by a few drops of hydrochloric acid. The curd is removed by filtration through fine muslin. After exact neutralization with sodium carbonate, the mixture is filtered through papier chardin. Finally, the filtrate is again filtered through a d'Arsonval bougie under pressure of carbonic acid gas. Chemically, lactoserum is a solution in which sodium chloride, milk sugar, and phosphates of the alkalies and

alkaline earths form the principal constituents. Lactoserum, in addition, contains certain ferments, some of which are found in many extracts of animal organs and animal sera. Blondel injected lactoserum subcutaneously and found that the specific action of these ferments was pronounced. His results seemed to show that lactoserum had a marked effect in lowering the arterial blood pressure, or what might be more correctly termed a regularization of blood pressure. He gives an injection of 10 c.c. and repeats it every twenty-four hours until the blood pressure falls to normal. After this the injections are continued for four or five days longer, and then a weekly injection for a month. If the pressure rises the injections may be more frequent. When the pressure remains normal, a monthly injection is given for three months. The injection is made into the muscles of the thigh or the gluteal region. Sometimes a mild erythema is seen. Usually the injection is not painful. No abscess has occurred in more than 1000 injections. Blondel made use of these injections for the treatment of arterial hypertension in arteriosclerosis, with striking results. A fall in the blood pressure was regularly noted with an alleviation of the general symptoms. Several of these patients had albuminuria, and apparently the lactoserum increased the albuminuria during the first days of the treatment. Blondel believes that if the albuminuria depends upon the hypertension alone, it will disappear quickly and permanently when the treatment is maintained. If, on the other hand, the albuminuria is the result of a true nephritis, it will return to its original degree after the initial increase. He believes that this fact may serve to determine whether an albuminuria is due to an organic kidney lesion or simply to the hypertension. Blondel also used lactoserum in the treatment of certain infections, with variable results. The serum had no apparent effect upon cases of puerperal infection, postoperative peritonitis, and typhoid fever. In pneumonia he had rather remarkable and constant results, though the number of cases (twelve) so treated does not allow any definite conclusions. His cases of pneumonia seemed to defervesce usually after the second injection, though at times defervescence occurred after the first injection.

The Therapy of Gout.—UMBER (*Therap. d. Gegenwart.*, 1909, ii, 73) arrives at his conclusions regarding the treatment of gout after considerable investigation of the metabolism of gouty and of normal individuals. His researches have been carefully conducted from a chemical point of view and include studies on the metabolism of 137 cases of gout. The elimination of uric acid, according to Umber, follows typical curves. The amount of endogenous uric acid grows less and less until the onset of an acute attack of gout, when there is a rise in the curve. This rise attains its maximum height two or three days after the onset of the acute attack. Then there is a gradual falling off in the uric acid elimination to amounts below the normal during the intervals between the attacks. These curves of uric acid excretion are typical of gout, as Umber shows by comparison with other diseases in which there is a uric-acidemia. In demonstrating the failure of the tissues to rid themselves of the small amount of endogenous uric acid, even after prolonged use of purin free foods, Umber's results confirm the researches of Brugsch and Schittenhelm. In view of this fact, it is to be expected that the excretion of the

exogenous uric acid following the ingestion of purin rich foods would be much less prompt than in normal subjects, and this is found to be the case. Umber concludes from these studies that there is no medicinal treatment of gout other than measures directed to relieve the symptoms at the time of the acute attacks. In the intervals therapeutic effort must be directed entirely to a consideration of the diet. The gouty person should never take more than 200 grams of meat a day, and when an attack is impending no meat should be allowed. It is still further advisable to arrange several purin fast days in each week, and thus give the body the opportunity to eliminate its excess of uric acid. Umber is emphatic that this regimen must be kept up for months and years in order to avoid the later severe stages of this disorder. Drinking large amounts of water aids in the excretion of uric acid, but, contrary to the long accepted opinions. Umber declares that alkaline waters have the opposite effect. None of the alkaline or mineral waters has any specific effect upon gout, and this is especially true of the lithia waters. The good results obtained from spa treatments are due to factors other than the waters. Umber is of the opinion that none of the various remedies directed against the uric-acidemia has any effect, since it is not the amount of uric acid in the blood that causes the trouble, but the deposition of sodium urate in the cartilages. The blood is always able to dissolve more uric acid than it contains. No remedy has been found to effect the sodium urate deposit. It has been noted that the excretion of uric acid diminishes after exercise, even when the diet is purin free. Umber thinks that this signifies that an increased oxidation brings about a lysis of the purins in the body. He believes, therefore, that carefully regulated exercise is of value in the treatment of gouty patients.

FALKENSTEIN (*Berl. klin. Woch.*, 1908, xxxvi, 1649) advises the use of hydrochloric acid in the treatment of gout on the following principles: He says that by the use of hydrochloric acid the proteins are more readily broken down, and consequently less nitrogen remains in the body, and that with an increased output of nitrogen, there is a diminished formation of uric acid. Furthermore, the body alkalies are diminished by the hydrochloric acid treatment, and therefore there is a lack of the necessary alkalies to combine with the uric acid and form the insoluble sodium urate. For similar reasons he prefers the use of sodoglodine (a combination of iodine with vegetable proteid) in the treatment of gout. Sodoglodine takes up sodium and potassium from their combinations and is excreted in the form of sodium or potassium iodide. By so doing the sodoglodine withdraws alkalies from the body. He also believes that sodoglodine increases the excretion of nitrogen and diminishes the formation of uric acid. He gives it in tablet form after meals, over long periods of time, gradually lessening the dose.

The Influence of Hydrochloric Acid upon Deposits of Urates.—STAAL (*Zeitschrift f. Phys. Chem.*, 1908, ii, 97) speaks of the experiments of von Loghen, and adds observations of his own of contradictory nature. Von Loghen found that when uric acid is injected underneath the skin it becomes soluble in the serum and is excreted. However, it is possible to cause a precipitation of the insoluble urates, though this does not occur in normal tissues. Von Loghen produced this deposition

of urates by feeding his animals alkalies. If the urates are precipitated, von Loghen believes that they are absorbed by the action of phagocytes. Furthermore, he noticed that the urates in the protoplasm of frog leukocytes are made soluble by the action of acids. Von Loghen then fed hydrochloric acid to rabbits, and found that he could control the precipitation of the insoluble sodium urate. Staal says that the solubility of the urates depends upon the sodium ion concentration of the dissolving fluid, and if we accept the solvent action of hydrochloric acid we must assume that the sodium ion content of the body fluids is reduced by its use. The theory that hydrochloric acid withdraws alkalies from the body is a very plausible one, but lacks proof. Staal gave hydrochloric acid to rabbits, and by very exact methods determined the sodium and chlorine content, the specific conductivity, and the freezing point of the blood serum and of the serum expressed from the subcutaneous connective tissue. He made controls on rabbits not fed with hydrochloric acid, and found that the osmotic concentration remained the same. The sodium content of the hydrochloric-acid-fed animals was indeed not lessened, but increased above that of the controls. Therefore, Staal says, a different explanation must be advanced for the possible therapeutic benefits derived from the use of hydrochloric acid. However, the conclusion that hydrochloric acid is of no therapeutic use in gout cannot be drawn from these experiments, because of the probable differences between human gout and artificial deposits of urates.

Iron as a Substitute for Bismuth in Röntgen-ray Work.—Talge (*Münch Med. Woch.*, 1909, xv, 758) speaks of Lewin's suggestion to use the magnetic oxide of iron as a substitute for bismuth in Röntgen-ray photography. He calls attention to some practical disadvantages of the magnetic oxide of iron. It is usually not carried in stock by druggists, and when obtained it must be pulverized, which takes considerable time and is expensive. Therefore, Talge advises, for practical reasons, the use of the red oxide of iron, which may be obtained in the finely pulverized form commonly known as polishing rouge. This is much less expensive than bismuth and answers the same purpose as the magnetic oxide of iron. Talge, himself, has taken 50 grams of the red oxide of iron with no untoward effects.

A Report of Eleven Cases of Staphylococcic Infection, Treated with Leukocyte Extract.—Hiss and Zinsser (*Jour. of Medical Research*, 1909, iii, 245) have treated eleven cases of staphylococcic infection by the injection of leukocyte extracts. In all but three of these the processes consisted of furunculosis of chronic nature, and had lasted, in spite of surgical and dietetic treatment and in some cases in spite of the most desirable hygenic conditions, for periods ranging from several months to four or five years. In all but one of the more chronic cases there was apparently complete cure, and that one case was much improved. The local and general improvement following the injections were even more striking in the acute cases. Hiss and Zinsser say that they have no hesitation in concluding that marked improvement in, and often cure of, localized staphylococcic infection may be obtained by careful and systematic treatment with leukocyte extract.

PEDIATRICS.

UNDER THE CHARGE OF
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The Pathology of Noma.—CRANDON, PLACE, AND BROWN (*Boston Med. and Surg. Jour.*, 1909, clx, 473) report 47 cases of stomatitis in the course of measles, 7 of which went to the stage of definite gangrene of the lips and cheeks; 2 of the latter recovered. Their investigation concerning the pathology of the condition leads them to believe noma to be due to a fusiform bacillus, which grows best along the edge of the necrotic tissue adjoining living tissue. In some cases it excites almost no inflammatory reaction; in other cases the reaction is considerable. In the necrotic tissue the fusiform bacilli rapidly die out and the tissue becomes invaded by various other bacteria. Noma is not a contagious disease and patients suffering with it need not be isolated. Any uncared for mouth, particularly in a sick child, and especially after measles, may contain Bacillus fusiformis and Spirocheta gracilis. In such a mouth these organisms may be found without ulceration, or in the lesions which have been described as stomatitis gangrenosa, Vincent's angina, and noma. The lesions, in other words, may be only round the roots of teeth, on the tonsils and pillars, on the inner side of the cheeks, in the nasal fossæ, on the external ear, and about the genitals. Any of these conditions, including the extensive gangrene and sloughing of so-called noma, may be different stages of the same disease, which may be, therefore, considered as not necessarily a specific disease, but as the successful ingress of mouth bacteria into tissue rendered non-resistant by uncleanliness and preceding disease.

Appendical Abscess in a Twenty-seven-months-old Child; with an Analysis of Infantile Appendicitis in the Johns Hopkins Hospital.—CHURCHMAN (*Johns Hopkins Hosp. Bull.*, 1909, xx, 31) reports the case of a boy, aged two and one-quarter years, who was admitted because of painful urination, which had existed, however, on and off for more than a year. A vesical calculus was supposed to exist, partly because of the history and symptoms, and partly because of a shadow seen on *x*-ray examination, but a stone could not be found by the examination under ether. The pain on urination disappeared, however, after the examination. Several weeks later there were abdominal cramps and fever, and abdominal distention; pain and tenderness, especially in the right side, developed, and a diagnosis of appendicitis was made on the fifth day; there were no urinary symptoms or vomiting. The operation revealed an abscess, which was drained and counterdrained through the flank; the temperature did not return to normal until the ninth day. This as well as the high pulse existing (180) were thought to be due to iodoform poisoning, but the removal of the gauze did not improve conditions. Plain gauze he considers better for drainage in young children. Of 1223 cases of

appendicitis noted at the Johns Hopkins Hospital, 9 were in children under 5; 6 of these were boys. In one of the instances 2 paternal uncles had been operated on for the disease. Five of the patients gave no history of previous attacks; in all 5 the appendix was found perforated; one of them had had general peritonitis, 1 spreading peritonitis, 2 had abscesses, and 1 a gangrenous appendix with beginning abscess. The remaining 4 patients had had previous attacks: 1 six months before admission; 1 had had two attacks, another had had an attack two years before the operation, and the fourth was attacked shortly before the operation. In 4 the diagnosis presented difficulties, tuberculous arthritis, general peritonitis, cerebrospinal meningitis, and vesical calculus being the diagnoses made respectively. All urinary symptoms should suggest the possibility of appendicitis, and in infants with apparent hip-joint disease, particularly if the thigh be flexed, appendicitis should be kept in mind. Palpable resistance on the right side by rectal examination is one of the most frequent findings in appendicitis. The tendency to early perforation in children (7 cases) must be remembered; also the frequency of spreading peritonitis. Intestinal obstruction occurred in 4 cases. The outlook, if early operation is performed, is good, unless peritonitis has set in, when the case is almost hopeless. Besides intestinal obstruction, the only complication which arose after the operation was pneumonia in one case.

OBSTETRICS.

UNDER THE CHARGE OF

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Uterine Contractions.—Bell and Hick (*Brit. Med. Jour.*, March 27, 1909) report the following results in their studies upon the physiology of uterine contraction. They found that extracts prepared from the ductless glands increase uterine contraction, and in varying degrees raise blood pressure. The pituitary and adrenal extracts act upon the involuntary muscle in general. They also increase blood pressure. Thyroid extract lowers blood pressure, but increases uterine contractions. If convulsions occur, the blood pressure rises. Ovarian extract from pregnant animals seems to control uterine contractions, especially in their expulsive efforts. The secretion obtained from the uterus acts upon the inactive uterus, as do the pituitary, adrenal, and placental extracts. It does not, however, raise blood pressure. Uterine secretion and placental extract are somewhat similar in their effect. Uterine secretion seems to act as a specific in producing uterine contractions. Calcium salts show a definite influence upon uterine contractions, with a sight but definite rise in blood pressure. A slow, forcible, and rhythmic contraction is obtained—the type seen in labor. Uterine secretion and calcium salts possess the most specific action in causing uterine

contractions of all the substances studied. The normal non-menstruating, non-pregnant uterus does not contract at all. During menstruation the uterus is in a condition of constantly recurring expulsive contractions. During normal pregnancy the uterus contracts and relaxes without expulsive force. This develops actively during labor. At present no satisfactory uterine extract or specific calcium salt is available for therapeutic purposes. The pituitary extract will soon be available in hypodermic form. A dose of 2 c.c. of the infundibular extract should be given hypodermically, and repeated if necessary. It is especially valuable in cases of shock, in which it is desirable not only that the uterus should contract, but that the blood pressure should be raised. This may also be used in place of physostigmine in paralytic distention of the bowel. Calcium salts have a valuable effect in slowing the heart and strengthening the heart beat.

Adrenalin in Cesarean Section.—BOGDANOVICS (*Zentralbl. f. Gyn.*, No. 12, 1909) reports the case of a primipara, aged thirty-one years, with flat rachitic pelvis. As spontaneous labor failed, the patient was delivered by Cesarean section, and a hypodermic injection of ergotin was administered to secure uterine contractions. A packing of uterine gauze was carried through the uterus into the vagina. The uterine incision was closed with catgut. Although the uterus at first contracted well, it dilated later, with considerable hemorrhage which was not promptly controlled by massage and hot salt solution. Accordingly 1 c.c. of 1 to 10,000 tonogen solution was given in the uterine wall. The uterus promptly contracted, the patient making an uninterrupted recovery.

Extensive Stenosis of the Vagina following Spontaneous Labor.—SAMSON (*Zentralbl. f. Gyn.*, No. 12, 1909) reports the case of a patient who gave birth to a dead child after a labor lasting twelve hours. The head of the child was visible for eight hours before its expulsion. The labor pains ceased for four hours and then returned. The laceration of the perineum was not closed. A vesicovaginal fistula developed. The patient had for some time a brownish discharge, and made a very tedious recovery. On examination the vagina was found full of scar tissue, with a vesicovaginal fistula beneath the urethral orifice. The scar tissue extended directly to the cervix, and it was difficult to recognize the cervix in the scar tissue. An operation was performed to close the fistula by loosening the tissue first, and using tampons of gauze. Six months after this operation it was possible to close the fistula. The final result of operation was satisfactory.

Internal Hemorrhage in a Pregnant Woman.—BRINDAU and JEANNIN (*l'Obstétrique*, February, 1909) report the case of a multipara brought by ambulance to a hospital in the eighth month of pregnancy. During the night preceding admission she had been taken with severe pain more pronounced on both sides of the abdomen. This pain had increased in severity. The patient gave a history of two abortions, in one of which interference with the uterus had been practised. On admission she was suffering from shock, and had vomited a greenish

material. The abdomen was not distended and showed a uterus pregnant eight months. The uterus was firmer than normal, and it was difficult to palpate the fœtus. There was no vaginal discharge. The cervix was slightly dilated, the fœtal head was in the pelvic brim, and the membranes unruptured. The urine contained no blood. An exact diagnosis could not be made, but it was determined to empty the uterus as soon as possible. The cervix was dilated to 9 cm. by Bossi's dilator, and a dead child, very pale, was easily delivered by Tarnier's forceps. A hand introduced within the womb found upon the right and upper portions of the uterus the placenta completely separated and a clot of blood within the membranes. The hand could not detect perforation of the uterus. An intra-uterine injection was given and lacerations in the vagina were closed. The uterus and vagina were tamponed with sterile gauze. On the following morning the patient vomited freely, the pulse rose to a high degree of rapidity, abdominal pain developed, but the uterus remained contracted and there was no uterine hemorrhage. Although free stimulation was given, the patient rapidly failed and died. At autopsy the peritoneal sac contained a large quantity of blood, especially abundant in the region beneath the liver. The uterus showed a solution of continuity upon its posterior aspect, circular in shape, and about the size of a silver quarter. The edges of this opening were composed of cicatricial tissue, and the perforation had occurred over the centre of the placental attachment. The perforation had evidently been an old one; the placenta had been inserted over its site and had separated, followed by hemorrhage, the blood escaping through the perforation into the peritoneal cavity, and giving rise to peritonitis. The perforation had possibly occurred during some former intra-uterine manipulation, probably during the treatment or production of abortion.

The Treatment of Placenta Prævia.—Pfannenstiel (*Monats. f. Geb. u. Gyn.*, 1909, xxix) draws attention to the fact that while it is desirable to treat placenta prævia surgically, it may be impossible to transport the patients to a hospital. Students and practitioners must be taught those methods which they can carry out under ordinary circumstances. The use of the elastic bag and artificial rupture of the membranes are especially valuable. The bag must be introduced with the aid of a speculum, the cervix being dilated sufficiently. A forceps with a suitable pelvic curve is necessary. The fœtal membranes must be ruptured through the introduction of the bag. If the placenta covers the os completely the thinnest portion of the placenta must be selected for puncture. The bag should be distended with 500 c.c. of sterile salt solution, and the weight of one kilo should be attached to the bag. This method gives admirable results.

Thies (*ibid.*) draws attention to the value of premature rupture of the membranes in placenta prævia, vaginal Cesarean section, and the use of the elastic bag within the fœtal sac. The cases must be selected in accordance with the conditions present in the individual patient.

Vaginal Ovariotomy during Labor.—Röhl (*Monats. f. Geb. u. Gyn.*, 1909, xxix) reports the case of a primiparous patient who had noticed marked increase in the abdomen during the latter months of gestation.

She had indefinite abdominal pain for eight days, and the amniotic liquid had escaped twenty hours before admission. On examination Douglas's cul-de-sac was filled with a slightly elastic tumor. The cervix was very difficult to find, and just above it the fœtal head could be felt through the lower uterine segment. A vaginal operation was performed and a cyst removed containing four separate compartments. It was necessary to empty this to deliver the tumor. After removal of the tumor the child was delivered by the high application of forceps without especial difficulty. The placenta was manually delivered. The vagina was then opened in Douglas's cul-de-sac and the tumor found limited by adhesions, which were separated with considerable difficulty. The tumor was finally delivered through the vagina and its pedicle ligated. The patient made a good recovery.

Delivery with the Formation of a Uterine and Abdominal Fistula.—DOBBERT (*Zentralbl. f. Gynak.*, No. 11, 1909) reports the case of a primipara, aged nineteen years, who was taken, after examination by a midwife, with a chill. The pelvis was contracted so that spontaneous birth was impossible. As the chill seemed to indicate infection, the patient was delivered by extraperitoneal section, followed by the formation of a uterine and abdominal fistula. The patient made an excellent recovery, and involution proceeded in a satisfactory manner.

The Repair of Recent Lacerations of the Perineum.—SIGWART (*Zentralbl. f. Gynäk.*, No. 10, 1909) draws attention to the method of closing recent lacerations of the perineum by the use of clamps. In 125 cases so treated all but 2 closed by primary intention. The clamps take the place only of those external stitches which were formerly inserted with silk or silkworm gut. In extensive lacerations the mucous membrane of the vagina must be closed with catgut.

GYNECOLOGY.

UNDER THE CHARGE OF

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The Use of Bacterial Vaccines in the Treatment of Septic Infections.—OASTLER (*Amer. Jour. Obst.*, 1909, lix, 594) reports a case of chronic sepsis following a miscarriage at three months, steadily getting worse with little or no hope of recovery, improving steadily after commencement of the vaccine treatment. An abdominal section had been made and the wound persistently refused to heal, discharging very freely, but responding after vaccine infections. Several cases are reported, and Oastler believes that: (1) Apparently favorable clinical results have been obtained with the use of vaccines of streptococcus, staphylococcus, Bacillus coli, Bacillus mucosus, and gonococcus. (2) All but gonococcic vaccine should be autogenous. (3) Vaccines are not "cure-alls"

but seem to aid materially in combating the septic process, the effect being gradual and progressive. (4) Vaccines are required especially when the blood shows poor resistance, that is, low leukocyte count and high polymorphonuclear. (5) In violent cases of acute sepsis, no resistance can be created and no effect obtained. (6) The negative phase is rarely obtained. (7) The positive phase is more often obtained. Blood cultures are generally negative. (9) Wound discharge increases soon after injections. (10) Good results have been obtained with all the organisms tried, but the least satisfactory with Streptococcus longus. (11) The pulse may remain rapid sometimes after the temperature falls. (12) As yet there have appeared no ill effects from injections. (13) The dose is problematical and purely experimental. The site of the injection is the same, as is also the frequency. Too large a dose does harm, and small doses give better results than large doses. (14) If the negative phase appears, one should delay the injection and reduce the dosage. (15) The opsonic index is uncertain. The leukocyte count with polymorphonuclear count gives the best indication of the resistance of the patient.

Endometritis.—MUNDELL (*Amer. Jour. Obst.*, 1909, lix, 608) believes: (1) The classification of endometritis should be acute and chronic. To further subdivide these leads to much confusion and does not materially aid the clinician. (2) Uncomplicated cases are not very common and an uncomplicated chronic case is a very rare condition. (3) Normally, the endometrium is free from bacteria. (4) Treatment of chronic endometritis, to be successful, should always to be carried on in conjunction with the treatment of the associated conditions.

A Case of Ovarian Transplantation.—CASALIS (*Jour. Obst. and Gyn., Brit. Emp.*, 1909, xv, 325) removed the appendages of a woman, aged twenty-six years. Immediately thereafter he sutured a part of one of the ovaries, of the size of a small walnut, to the denuded surface of the uterus, using a number one, circular catgut suture. Two and a half months later menstruation occurred. It was painless, lasted two days, was of a fair quantity, and continued regularly every twenty-four to twenty-six days. At the end of three years the patient began to have premenstrual attacks, violent headache followed by intense abdominal pain, three or four severe rigors, accompanied by blueness of the face and extremities, became almost pulseless, vomited incessantly, and had one or two very malodorous stools. Four to five hours later a reaction sets in, noted by heavy perspiration, flushed face, bounding pulse, and the appearance of menses. The flow at the end of four years is very scant and irregular. Casalis believes an early surgical menopause is occurring.

Intestinal Injury in Gynecological Operations.—A. BARTH (*Monatssch. f. Geburtsh. u. Gynäk.*, 1909, xxix, 153) states that of fourteen cases of intestinal injury during gynecological operations reported from Chrobak's clinic, in 1903, eleven died, 78.5 per cent. Barth, on the other hand, observed nine such cases with no deaths, although some of the cases were as difficult and as complicated as any reported. He arrives at the conclusion that with expert treatment the patient may not

only be safely tided over the primary dangers of abdominal infection, but intestinal function may also be restored. Shock, which was formerly so greatly feared as it was usually the direct cause of death, at the present time is an unimportant factor in the light of the modern methods of anesthesia and intravenous infusions of saline solutions. The prognosis in accidental injury of the intestines during gynecological operations may therefore be considered very favorable.

Ovarian Fibroma with a Twisted Pedicle.—MERIEL (*Ann. de gyn. et d'obst.*, 1909, xxxvi, 117) had a patient, aged fifty-six years, who consulted him for indigestion. She had no pelvic symptoms. An examination of the abdomen revealed the presence of the tumor and considerable ascitic fluid. The abdomen was opened and the ovarian fibroid, weighing two kilograms, and considerable ascitic fluid were removed. The pedicle was twisted one complete revolution and the circulation was not materially modified. The uterus and opposite ovary seemed to be normal. The absence of symptoms other than indigestion was considered unique

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Submucous Perineorrhaphy.—W. WAYNE BABCOCK (*Jour. Amer. Med. Assoc.*, 1909, lii, 1568) describes a method of perineorrhaphy for secondary operation devised by him in 1902 and named submucous perineorrhaphy. The term infers a procedure different from that illustrated and described in the text of the paper. Babcock refers to the illogical features of various procedures for restoration of the lacerated perineum, and mentions the special advantages of his operation as follows: (1) No tissue is removed or extensive denudation made. (2) Buried, absorbable, layer sutures are used exclusively, none of which penetrates the skin or mucous membrane. (3) The operation is done from the outside of the vagina, rendering the introduction of sutures easier and the exposure of tissues better than with those operations done from within the vagina. (4) Each structure is sutured with precision under the guidance of the eye; there is no blind groping with the needle for tissues not seen and perhaps not felt. (5) Each of the layers of the perineal floor—vaginal wall, submucosa, muscular supports, fascial planes, and skin—is united seriatim in layers after the plan of the better types of herniotomy. (6) The vagina is not separated from the rectum and therefore there is no danger of wounding the bowel. For the operation Babcock claims several other advantages, among which are restoration and increase of length of the vagina instead of shortening the posterior wall of the vagina, as occurs with many of the older operations, and affording greater support to the anterior vaginal wall. The description and illustrations do not refer to the worst form of lacerations of the perineum, that is, complete tears. It is in the severer forms of lacerations, those involving the rectal mucosa, that the greatest danger arises from infection.

The Treatment of Uterine Retrodisplacements.—BALDY (*Surg., Gyn., and Obst.*, 1909, viii, 421) reports his advocacy of the method bearing his name of shortening the round ligaments in the treatment of retrodisplacements of the uterus. His present recommendation is based upon an experience of nearly two hundred operations in his clinic.

This number is apparently much lower than the real number, as others have employed it in a larger number of cases. After the operation, according to Baldy, the uterus is held forward by three forces: (1) The pressure of the intra-abdominal force on its posterior surface; (2) the resistance of the encircling band of round ligaments, and (3) the pull forward and downward of the round ligaments at their attachment at the uterine cornua. The whole structure is steadied by those portions of the round ligament running to the normal abdominal attachments. As end-results Baldy has knowledge of 20 to 30 pregnancies following the operation, and in no case has there been the slightest irregularity, although a number of the women had had trouble in former pregnancies. In no case subsequently examined could the fact of a previous operation be discovered. For this operation Baldy claims it is the only one extant that accomplishes what was contemplated by Nature—"A uterus with the fundus forward of the direct line of the axis of the pelvis, freely movable in all directions on the cervix as a movable pivot, the fundus raised up to and above the iliopectineal lines, and the ovaries swung correspondingly high and free from all attachments on the posterior side of the broad ligaments."

OPHTHALMOLOGY.

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Pathological Anatomy and Pathogenesis of Cyanosis of the Retina.—Baquis (*Graefe's Archiv*, 1909, lxviii, 177) observes that individuals affected with congenital cyanosis sometimes present ocular complications, notably cyanosis of the retina. This complication frequently passes unperceived, since it does not always occasion any diminution of the vision. In intense cyanosis, the excessive amount of carbonic acid in the blood excites the vasoconstrictor centre in the bulb, causing considerable venous stasis in the retina. In severe cases the iris also becomes congested; it is, in fact, a matter of cyanosis of the eye rather cyanosis of the retina alone. The iridocorneal angle becomes the seat of a slow inflammatory process, which finally terminates in its obliteration with consequent glaucomatous hypertension.

Remote Results of Extraction of the Crystalline Lens in High Myopia.—From 1893 to 1906 Sattler practised extraction of the transparent crystalline lens 338 times upon 242 patients. Hoepner (*Clin. ophtal.*, May 10, 1909, 258) analyzes this material. The conclusion to be derived from the analysis is that removal of the transparent crystalline lens does

not guarantee against progress of the myopia, that it does not diminish the proportion of detachments of the retina, but rather, perhaps, increases the percentage somewhat, and that it does not tend to limit chorioretinitis nor disease of the vitreous. Hoepner recommends the operation, however, for the reason that the subjects operated upon—those who have had the good fortune to have escaped without complications—are more comfortable and have better use of their vision than before. Commenting upon this, Dor justly asks whether such a result is not rather inadequate. It was precisely to avoid these very complications of myopia that most was hoped for from the operation, rather than the mere satisfaction of diminishing the strength of the correcting glass.

Miners' Nystagmus.—Romiee (*Annal. d'oculist*, June, 1909, 451) has made a study of the manner of working of miners in the mine, during the course of which he examined 600 individuals affected with nystagmus. According to certain authors, miners' nystagmus is consecutive to a myopathy of the elevator muscles of the eye. This myopathy is held to be due to the excessive demands made upon the organ of vision, favored by the anemia with which the subjects are frequently affected, the insufficiency of illumination being regarded as of quite secondary importance. Vertical nystagmus is supposed to depend upon the fact that the miner is constantly obliged to direct his gaze upward. Romiée has found that most miners when they work do not look upward at all, but either directly forward or downward; while among foresters, who have the gaze constantly directed upward, nystagmus is infrequent. Romiée concludes that the principal ccause of this affection is insufficiency of illumination. Nystagmus, in fact, only occurs in workers in coal mines where the illumination is not sufficiently intense, and not in those employed in mining other substances. It would hence seem preferable to speak of "coal" miners' nystagmus. Nystagmus was less frequent in mines where unprotected lamps were used; the safety lamps are soon covered by a layer of dust which greatly reduces the intensity of the light, even as much as 70 per cent. The affection was found to have diminished 50 per cent. in mines where electric lamps were employed. The bearing of this upon prophylaxis is obvious: amelioration of illumination in mines should be secured.

Physiological Muscæ Volitantes.—Fortin (*Rec. d'ophtal.*, February, 1909, 49) has made an entoptic study of these objects; he finds that the vitreous contains normally four kinds of elements: small granular spheres, pearl-like bodies in strings, elongated filaments, and glomerules, or muscæ volitantes par excellence. All these varieties are visible, particularly by individuals having manifest ametropia and long lashes (the latter when incurved forming a series of apertures or stenopaic slits). Whatever be the histological signification of these formations and their physiological role, they are not pathological, but are found in the healthiest eyes. Pathological muscæ undoubtedly exist, but they are usually immobile with reference to the point of fixation; they are due to opacities of the cornea or lens, and in the latter case they may be the earliest symptoms of beginning cataract. Guerin records in his treatise upon diseases of the eyes, published in 1769, that Bartolini, replying to the physician, J. L. Hahnemann, who complained of seeing spider webs

dancing before his eyes, wrote: "The spider webs of which you complain need not alarm you in the least. I have been having the same experience for more than thirty years, but I was reassured upon learning that they were the occasion of more anxiety than real trouble." What was true in 1769 is still true.

Visual Disturbances from Atoxyl.—COPPEZ (*Clin. ophtal.*, June 10, 1909, 273) emphasizes the untoward effects of atoxyl in internal or external use. Atoxyl even in minimum doses may cause complete and incurable blindness; practitioners who have recourse to this dangerous agent should be on their guard. Ophthalmologists ought to banish atoxyl, and should take pains to inform their colleagues, who practise dermatology or medicine in the tropics, of the dangers to the sight from this preparation.

HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

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The Fight Against Tuberculosis.—The International Conference on Tuberculosis was held this year at Stockholm, the session lasting three days, July 8 to 10. The July issue of *Tuberculosis* contains the papers, and from these the following abstracts are taken:

WIDSTRAND tells of the work of the National Antituberculosis Association in Sweden. This body, organized in 1904, now has a membership of 22,457, equivalent to 4.16 per cent. of the total population. The revenues of the society come from three sources: (1) Members, fees, which are two crowns per year for the well-to-do and one crown for the poorer; (2) donations; and (3) the sale of charity stamps. The total for four years for the sale of stamps amounts to 263,373 crowns and is as much as the fees and donations together. The work of the league has been largely along the line of giving instructions concerning the disease and its prevention to the public. Nearly 1000 popular lectures have been given and eight pamphlets have been distributed, in editions of from 20,000 to 250,000. All schools have been supplied with manuals of instruction. In the second place, the league has devoted its energies to the construction and multiplication of sanatoriums. A Government Commission was appointed to ascertain the number of open cases of pulmonary tuberculosis in the country. This was found to be about 30,000, and it was learned that about one-third of these were in immediate need of institutional help. In 1908 the Parliament made provision for the expenditure during the following ten years of the sum of 11,042,250 crowns in the construction and maintenance of sanatoriums. The law now provides for compulsory notification of the disease and the disinfection of infected houses. Wet nurses and those who handle milk must be shown to be free from the disease, and both the teachers and pupils in the schools are inspected. Dispensaries are kept up in the larger cities and model workmen's dwellings have been

built and are rented at low rates, provided their occupants live according to certain hygienic rules. Four villages with a high death rate from tuberculosis and in unsanitary condition have been taken in charge, supplied with physicians and nurses, and special inducements made to the inhabitants to improve their manner of living. Since 1906 the league has attempted to place the healthy children of tuberculous parents in the country under the care of healthy foster parents, following the recommendation in this particular of Grancher, of France, but this has not, so far, worked well on account of the unwillingness of the parents to part with their children.

RAW, of Liverpool, holds that lupus is caused almost exclusively by the bovine bacillus, and that it is conveyed to man in milk and in other bovine products or it is spread from person to person. He treats lupus with tuberculin made from human bacilli and pulmonary tuberculosis with that made from bovine bacilli. He states that he has treated more than 100 cases of lupus with bovine tuberculin with marked benefit, some being apparently quite cured. He has autopsied 33 persons with lupus, and in only three of these did he find the lungs at all affected. He has never seen people with pulmonary tuberculosis develop lupus, but in three cases he has seen lupus of the neck extend directly to the lung apex.

BUHRE, of Stockholm, tells more in detail of the attempts made in Sweden to follow out the recommendation of Grancher in removing the healthy children of tuberculosis parents. Fifty thousand kroner has been set aside for this purpose and 197 children have been cared for in this way. It is, of course, too early to tell what the results of this will be.

PANNWITZ, of Germany, discusses the construction and management of a sanatorium for tuberculous children. He holds that sanatoriums represent for curable cases the quickest and surest means of effecting a cure. Forest convalescent stations cannot take the place of sanatoriums, because they have not the required facilities. The children's sanatorium should have sick pavilions, one for each sex, reception rooms, and dormitories. Play grounds free from dust must be provided, and food should be abundant, savory, easily digestible, and nutritious. In practice it has been found desirable to keep a separate colony for those children suspected of being tuberculous. The children should be prepared for healthy rural occupations. Those found to be incurable should be placed in a section equipped with hospital comforts.

KLEBS, of Germany, holds that the Ehrlich theory does not hold for tuberculosis. Permanent immunity must be active, and can only be produced in livings beings who destroy newly invading germs. The antagonistic theory of immunity based on this view is supported by the fact that vaccinated individuals show partial variolous eruptions, genuine variola eruptions appearing in such cases on certain portions of the body, such as the back and the abdomen, and they are so much the rarer as the attacked child stands nearer the time of vaccination. Klebs thinks that the tubercle bacilli of the blind worm are the antagonists of the tubercle bacilli of warm-blooded animals, and he uses the former in treating disease caused by the latter.

RAW, of Liverpool, thinks that the ophthalmic and cutaneous tests

are valuable in the diagnosis of tuberculosis in man, that the subcutaneous test is good for animals, but not desirable in man. He holds that the von Pirquet test should be made with a strong tuberculin, otherwise no effect is produced. While he does not use injections of tuberculin in the diagnosis of the disease in man he does employ it in the treatment and thinks it valuable for this purpose.

On the other hand, TURBAN, of Switzerland, says that the conjunctival test must be absolutely discarded on account of its danger. The cutaneous reaction, he holds, is too delicate, showing up when there are only local and insignificant lesions. The subcutaneous test he regards as the best for diagnostic purposes, and holds that it is safe if properly applied. The opsonic index denotes tuberculosis if it is below 0.9 or above 1.1, and if the opsonins are at the same time thermostable; but the normal state of the index, between 0.9 and 1.1, does not exclude tuberculosis. If the opsonins are thermolabile, while the index is too low, no tuberculosis exists, but a reduction of the resistance against it, caused by other diseases (diabetes, syphilis, influenza), must be presumed. A strongly oscillating index denotes progression of the disease, while a gradual, uniform rise leads to the presumption that there is an improvement. Turban states that the serum of Marmorek is a specific remedy, useful in a limited number of early cases of pulmonary and other forms of tuberculosis, but that it does not immunize. The various tuberculins are also regarded as specific remedies, the best according to Turban's experience being Koch's old tuberculin. The use of tuberculins is, however, difficult and not free from danger. There is in certain individuals a limit beyond which it is dangerous to go, even when the increase is made slowly. Surest protection from danger is obtained by watching the temperature, which should be taken in the rectum every two hours, combined with exact observations of the diseased centre. There are pronounced centre reactions in the lungs without any rise in temperature which may demand a suspension of the treatment.

D'ALMEIDA, of Portugal, urges the inspection of school children, the teaching of hygiene, and the use of vacation colonies, especially on the sea shore.

ALTSCHUL, of Prag, says: The principal duty of the modern school is the hygienic education of youth, education for cleanliness, for bodily and mental ability. Such hygienic instruction in school, consistently carried through from the beginning, may and must be followed up in riper years by a methodical teaching of hygiene, when, among other subjects, the question of the combat against tuberculosis must be discussed. The compendiums serving as guides for the instruction must be written by physicians and not by pedagogues, because the knowledge of medical science rectified by medical practice is absolutely indispensable for this purpose.

FRANZ, of Vienna, makes an interesting report upon a thousand soliders discharged in 1901 and 1902 because they reacted to tuberculin. His conclusions are as follows: (1) At the age from twenty-one to twenty-three years the strongest individuals often react to diagnostic doses of tuberculin; (2) the frequency of the reaction varies with the nationality, being greatest in those among whom tuberculosis is most common, as

the Bosnians; (3) of those who reacted at that time, only a small percentage has developed clinical evidence of the disease since; (4) up to the present time no basis has been found, either in the quantity of tuberculin required to produce the reaction or in the intensity of the reaction, for drawing definite conclusions concerning the character and course of the incipient tuberculous disease; (5) a dose of less than 3 milligrams is often not sufficient to ascertain a latent tuberculous infection.

HOPE, of Liverpool, tells how tuberculosis has decreased in his city under improved hygienic conditions. In 1885 the mortality rate from this disease was 2.7 per 1000 among males, and 2.2 among females; in 1907 it was 1.9 and 1.1 respectively.

KÖHLER, of Germany, calls attention to the fact that consumptives are often neurasthenics, and he says that hygiene of the nervous system must begin in childhood. On account of the close relation between the hygiene of the nerves and the total energy of the body, the former must be considered, with the object of creating a strong and healthy people, as a part of the prophylaxis of pulmonary infection.

MORIN, of Switzerland, emphasizes the value of sunlight in both the prevention and treatment of tuberculosis.

ONODI, of Budapest, claims that the nose is often the seat of a primary tubercular infection.

PETREN, of Sweden, thinks that the sanatoriums should care for consumptives in all stages. He argues with much force that it is mutually beneficial to the incipient and the advanced to be kept together. The former are impressed with the gravity of the disease and stimulated to do their best, while the latter are cheered and saved from utter discouragement.

TAUSSIG, of Prag, dwells upon the desirability of more reliable and thorough statistics concerning tuberculosis.

UNTERBERGER, of St. Petersburg, discusses the hereditary transmission of tuberculosis. An inflammable building and a spark are necessary to a conflagration. The building may be fireproof; it may burn slowly, or it may be a tinder box. To prevent conflagrations we should build fireproof houses first of all, and then it is well to limit the flying sparks. Too much stress has been laid on the bacillus, and the warfare is being waged against the consumptive rather than the disease. The fear of the bacillus is warranted neither by biological research nor by practical observation. We must, of course, kill the bacilli, but we must give more thought to strengthening the body.

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